

Application Technology and Digital Marketing for The Improvement of Production Capacity in *Tempeh* Small Industry

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Abstract. This study explores the diversification of tempeh products through the integration of technology and digital marketing to enhance production capacity and market reach. Traditional tempeh production, often limited by manual processes and local sales, faces challenges in scaling up and competing in broader markets. By introducing advanced technological methods in production, including automated equipment and improved fermentation techniques, the quality and quantity of tempeh can be significantly increased. Additionally, leveraging digital marketing strategies, such as social media advertising, e-commerce platforms, and online branding, enables producers to tap into wider consumer bases, both locally and globally. This dual approach not only boosts production efficiency and output but also enhances market visibility and consumer engagement. The study aims to demonstrate how modernizing production practices and adopting digital tools can lead to sustainable growth, increased revenues, and greater competitive advantage for tempeh producers. Through case studies and data analysis, the research highlights successful implementations and provides practical recommendations for small to medium-sized enterprises (SMEs) looking to innovate and expand their market presence in the food industry.

1 Introduction

The small-scale tempeh industry has long been a cornerstone of local economies, providing both employment and a source of affordable nutrition [1]. However, traditional production methods and limited market reach have constrained the growth potential of these enterprises. As the demand for tempeh and its derived products increases both domestically and internationally, there is an urgent need to modernize production processes and expand

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market presence to stay competitive. This study explores the dual approach of product diversification and digital marketing to enhance production capacity and drive community development within the tempeh industry [2].

Product diversification involves introducing new variations of tempeh products to meet diverse consumer preferences and open new market segments [3]. By creating innovative tempeh-based products such as flavoured tempeh chips, tempeh sausages, and ready-to-cook tempeh meals, small industries can attract a broader customer base and increase their revenue streams. This approach not only adds value to the basic tempeh product but also creates opportunities for branding and differentiation in a crowded market [4].

In parallel, the integration of digital marketing strategies offers a powerful tool to reach wider audiences and engage customers more effectively. [5, 6]. Through targeted marketing campaigns, small tempeh producers can build strong brand identities, foster customer loyalty, and expand their sales beyond local markets. Product diversification involves expanding the range of products offered by a business to meet different customer needs and preferences. In the tempeh industry, diversification can include the development of various tempeh-based products such as tempeh chips, flavored tempeh, and tempeh burgers. Studies suggest that diversification helps in spreading risk, tapping into new markets, and increasing customer loyalty. It also allows businesses to capitalize on existing production capabilities while innovating to attract a broader consumer base. Research by Kariuki et al. (2018) indicates that product diversification in small food industries can lead to significant improvements in revenue and market penetration [7, 8].

Studies highlight those small businesses adopting digital marketing strategies experience enhanced visibility and customer engagement. According to Bautista and Blandres (2022), digital marketing tools like SEO, social media marketing, and online advertising are instrumental in driving traffic to small businesses' websites and increasing sales [9]. Combining product diversification with digital marketing can amplify the benefits of both strategies. Diversified products provide more content and variety for digital marketing campaigns, making them more engaging and appealing to a broader audience. Research by Lee (2021) demonstrates that businesses that effectively integrate these strategies see a more substantial improvement in their production capacity and market share [10]. The study emphasizes that small industries, including tempeh producers, should invest in training and resources to develop diversified product lines and robust digital marketing campaigns [11].

Kelompok Usaha Bersama (KUB) Rela is a collaborative business group dedicated to the production of tempeh, located in Jatimulyo, Yogyakarta. This collective operates with the goal of empowering its members through shared resources, knowledge, and labor, thus enhancing their economic stability and productivity. KUB Rela focuses on producing high-quality tempeh by adhering to traditional methods while incorporating modern practices to ensure consistency and hygiene. The group benefits from pooled resources, which reduces individual costs and risks, enabling them to invest in better equipment and technology. This collaborative effort not only boosts production capacity but also fosters a sense of community and mutual support among its members.

This study aims to demonstrate how the combination of product diversification and digital marketing can lead to substantial improvements in production capacity and overall business growth. By examining case studies and analysing data from community development initiatives, the study highlights the practical steps and benefits of adopting these strategies.

2 Methodology

2.1. Diversification

The methodology for this study on product diversification and digital marketing to improve production capacity in small-scale tempeh industries involves a mixed-methods approach. Initially, qualitative methods such as in-depth interviews and focus group discussions with tempeh producers, community leaders, and marketing experts were employed to gain insights into the challenges and opportunities faced by the industry [12]. This was complemented by quantitative data collection through surveys distributed to tempeh producers, capturing data on production levels, product varieties, and marketing practices before and after the intervention. The intervention itself consisted of training workshops on product diversification and digital marketing [13].

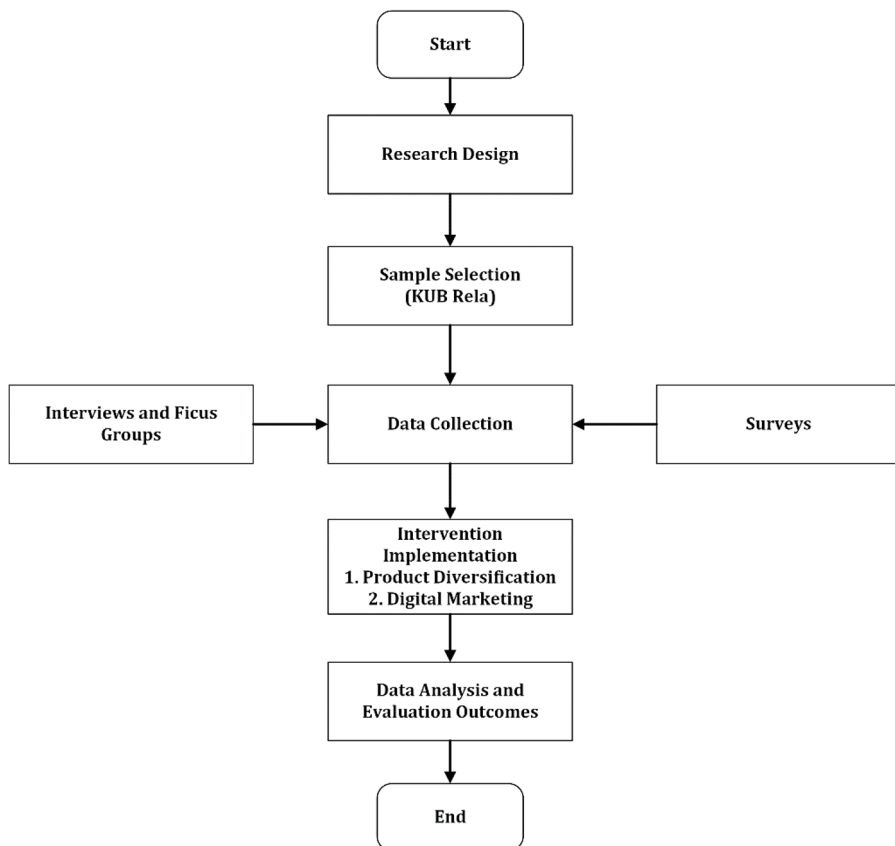


Fig. 1. Schematic diagram of the program.

Producers were trained in developing new tempeh-based products, enhancing their skills in recipe development, food safety, packaging, and branding. Concurrently, digital marketing workshops were conducted to educate producers on using social media, e-commerce platforms, digital advertising, and content creation to expand their market reach. The data collected was analysed using thematic analysis for qualitative data and statistical analysis for quantitative data [14]. The effectiveness of the interventions was evaluated based on increased production capacity, diversification of products, market expansion, and overall business growth, with ethical considerations ensuring informed consent and data

confidentiality. This comprehensive approach aims to provide actionable insights and practical recommendations for enhancing the sustainability and growth of small-scale tempeh industries through modern strategies. Our method is illustrated in Figure 1, which shows the whole system architecture.

2.2. Application technology for small industry tempeh

The application of technology in the diversification of tempeh products in small industries involves utilizing modern tools and methods to create a variety of innovative tempeh-based products such as tempeh chips. This approach not only helps in meeting diverse consumer preferences but also enhances production efficiency and market competitiveness that can be seen in Figure 2.

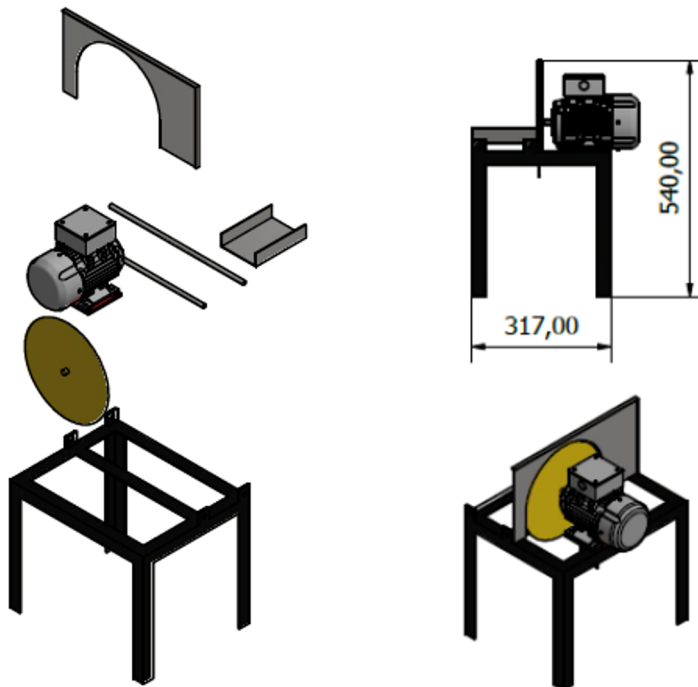


Fig. 2. Application technology for making tempeh slices.

Implementing automated machinery for tempeh production can streamline the process, reduce labour costs, and increase output [15]. For instance, automated tempeh incubators, cutting machines, and packaging units can significantly enhance productivity [4]. Automated systems ensure consistent fermentation conditions, leading to uniform product quality. This is essential for maintaining high standards and customer satisfaction [16, 17].

Advanced flavouring technologies enable the development of various tempeh flavours (e.g., spicy, sweet, or savoury), catering to different taste preferences. Utilizing biodegradable or recyclable packaging materials aligns with consumer demand for environmentally friendly products, adding value to the brand. Developing online stores or partnering with e-commerce platforms allows small tempeh producers to reach a wider audience beyond local markets. Social media, search engine optimization (SEO), and email marketing can effectively promote diversified tempeh products. Digital marketing tools help in engaging with customers, gathering feedback, and building brand loyalty.

2.3. E-commerce platform

Digital marketing on e-commerce platforms for tempeh chips involves a multifaceted approach to increase visibility, engage potential customers, and drive sales. First, creating a professional online store on platforms like Shopee (Figure 3) is essential, ensuring it is visually appealing, user-friendly, and optimized for mobile use. Search engine optimization (SEO) plays a crucial role by using relevant keywords in product titles, descriptions, and blog content to improve search rankings [18, 19]. Social media marketing is another critical component, where visually engaging content, influencer partnerships, and targeted ads on platforms like Instagram and Facebook can attract a broad audience. Email marketing helps maintain customer relationships by sending regular updates, promotions, and engaging content to subscribers.

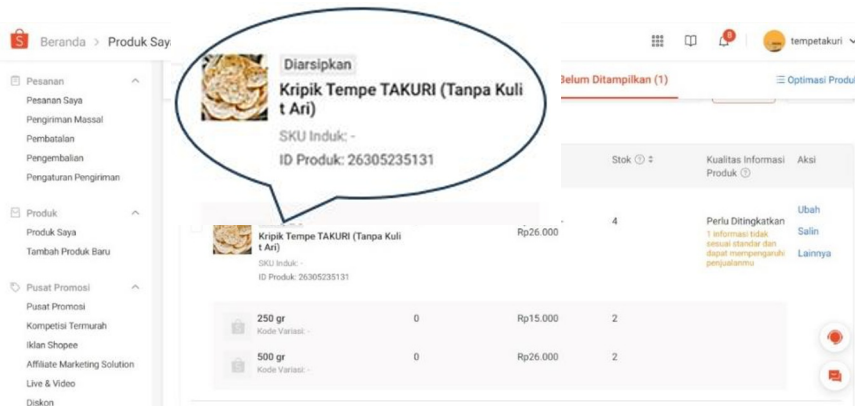


Fig. 3. E-commerce platform for Tempeh chips.

Running promotions and seasonal campaigns can attract new customers and boost sales. Tracking performance through analytics tools allows for continuous optimization of marketing strategies. Overall, a comprehensive digital marketing strategy on e-commerce platforms can significantly enhance the visibility, engagement, and sales of tempeh chips products.

3 Results and Discussion

3.1. Product Diversification

The integration of application technology and digital marketing in the production and sales of tempeh chips represents a significant advancement for small-scale tempeh industries. Application technology, such as automated slicers, dehydrators, and packaging machines, streamlines the production process, enhancing efficiency, consistency, and scalability. These tools reduce labour costs and time, allowing small businesses to produce high-quality tempeh chips that meet market demands.

On the marketing front, leveraging digital marketing strategies, including search engine optimization (SEO), social media marketing, email campaigns, and pay-per-click advertising, can dramatically increase product visibility and reach. For instance, creating a visually appealing online store and maintaining an active presence on social media platforms like Instagram and Facebook can attract and engage a broader audience. Collaborations with influencers and food bloggers can further amplify reach and credibility. Additionally, targeted ads and promotions can drive traffic to e-commerce sites, while

email marketing helps build customer loyalty and repeat sales. By combining these technologies and digital strategies, small tempeh industries can not only enhance their production capacity but also establish a robust online presence, ultimately leading to increased sales and market growth [20]. This holistic approach enables small businesses to compete more effectively in the market and respond swiftly to consumer trends and preferences.



Fig. 4. Soybean Tempeh.



Fig. 5. Tempeh slices for tempeh chips product.

Automated slicing machines precisely cut tempeh into uniform slices, significantly reducing the time and labour required compared to manual slicing. Consistency in slice thickness ensures even cooking, which is essential for achieving the desired texture and taste. Slicers with adjustable blades allow producers to quickly switch between different slice thicknesses, catering to various product lines without the need for multiple machines.

The tempeh slicing tool designed for the diversification of tempeh products significantly enhances production capacity by efficiently processing tempeh blocks into slices. Specifically, this tool is capable of slicing 500 grams of tempeh within just 5 minutes. This high efficiency allows for a substantial increase in output compared to manual slicing methods, which are slower and less consistent.

For example, if operated continuously for an hour, the tool can process approximately 6 kilograms of tempeh, assuming no significant downtime between batches. Over an 8-hour workday, this translates to a potential output of 48 kilograms of tempeh slices, significantly boosting production capacity and meeting higher market demands that can be seen in Table 1.

Table 1. Capacity of tempeh slices.

Description	Unit	Amount
Slicing tempeh	500 gr	5 minutes
	6 kg	60 minutes
	48 kg	8 hours

Table 2. Income production capacity.

Description	Unit	Amount (IDR)	Total (IDR)
Income per day	48 kg/day	35,000	1,680,000
Income per month	1,440 kg/month		50,400,000

The precise and uniform slicing provided by the tool also ensures consistency in product quality, which is crucial for consumer satisfaction and brand reputation. This capability is particularly beneficial for small-scale producers looking to diversify their product offerings, such as creating tempeh chips or other value-added tempeh products. By improving efficiency and consistency, the tempeh slicing tool not only enhances production capacity but also supports the scalability and profitability of small tempeh businesses, enabling them to compete more effectively in the market (Table 2).

3.2. Increased Market Reach via E-Commerce

The diversification of tempeh into tempeh chips has significantly benefited from the adoption of e-commerce, leading to an expanded market reach that was previously unattainable through traditional sales channels. By leveraging online marketplaces, small-scale tempeh producers have been able to connect with a broader audience, both locally and internationally. E-commerce platforms such as Shopee and Tokopedia have provided an avenue for these producers to showcase their tempeh chips to a diverse customer base, driving substantial increases in sales.

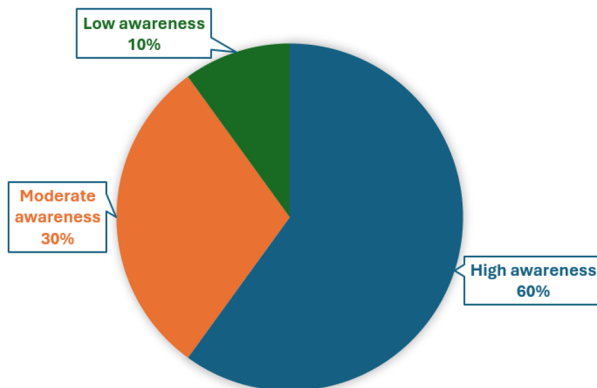


Fig. 6. The understanding regarding the use of digital marketing platforms.

The survey results reveal a varied level of understanding among respondents regarding the use of digital marketing platforms for selling tempeh chips. A significant portion of 50 respondents, about 60%, demonstrated high awareness, indicating familiarity with multiple

digital platforms such as Shopee, Tokopedia, and Instagram. This suggests that a majority are knowledgeable about the key tools available for online marketing and sales. However, 30% of respondents showed moderate awareness, recognizing only a few platforms, while 10% had low awareness, being familiar with just one or none (Figure 6). Confidence in using these digital marketing tools also varied, with 50% feeling very confident and another 30% somewhat confident in their abilities and 20% feeling not confident using this platform. Interestingly, the data in Figure 7, also highlighted a strong desire to improve digital marketing skills, with 80% of respondents expressing a high interest in learning more.

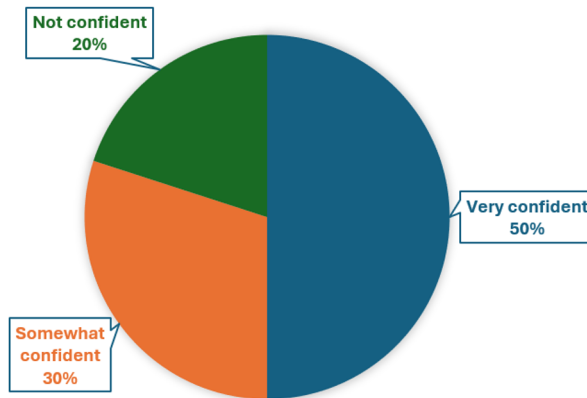


Fig. 7. Confidence in using digital marketing.

This suggests that while many respondents are already engaged with digital marketing, there is a clear opportunity to enhance their expertise, potentially leading to more effective marketing strategies and improved sales outcomes for tempeh chips.

4 Conclusions

In conclusion, the integration of application technology and digital marketing has the potential to revolutionize small-scale tempeh chip production. Application technology, such as automated slicing, dehydrating, and packaging machines, significantly enhances production efficiency, consistency, and scalability, allowing small businesses to meet increasing market demands with high-quality products. Concurrently, digital marketing strategies, including SEO, social media engagement, influencer partnerships, and targeted advertising, amplify product visibility and consumer engagement, driving traffic and sales. These combined efforts not only streamline operations but also create robust online presences, making it easier for small tempeh businesses to compete effectively in the market. By adopting these technologies and strategies, small-scale tempeh producers can improve their production capacities, expand their customer base, and achieve sustainable growth. This holistic approach empowers small businesses to innovate, respond swiftly to consumer trends, and ultimately contribute to the economic development of their communities.

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