

Implementation of Clustering Method for Digital Marketing Data on Culinary MSME Revenue in Makassar City

Sakinah¹, Syamsu Alam¹, Valentino Aris^{1,*}

¹Digital Business Study Program, Faculty of Economics and Business, Makassar State University, Makassar, Indonesia

Abstract

This research examines the implementation of digital marketing data clustering methods on the revenue of culinary SMEs in Makassar City using the K-Means method. The study finds that culinary SMEs using 2 to 4 social media platforms tend to have higher revenues, ranging from IDR 3,000,000 to IDR 4,000,000, compared to those using only 1 to 2 platforms, with revenues between IDR 500,000 and IDR 1,000,000. Correlation analysis reveals a strong relationship between the number of social media platforms used and monthly revenue, and a moderate correlation between the number of social media posts and revenue. These findings underscore the importance of using multiple social media platforms and maintaining consistent posting as effective digital marketing strategies. Recommendations for new entrepreneurs and culinary SMEs include enhancing knowledge and skills related to digital marketing and utilizing available training to maximize marketing potential and business growth in a competitive market.

Keywords: Clustering, Digital Marketing, Revenue, Culinary SMEs

1. Introduction

Entering the era of Industry 4.0, Indonesia has experienced rapid advancements in technology, digital innovation, biology, and physical sciences. The government, through the Making Indonesia 4.0 program launched by President Joko Widodo in 2018, has positioned the MSME (Micro, Small, and Medium Enterprises) sector as one of its main priorities [1]. This is based on the contribution of MSMEs to GDP, their ability to absorb labour, and their resilience in facing crises, including economic crises and the Covid-19 pandemic [2]. MSMEs contributed around 60% of Indonesia's GDP in 2019 and played an important role in creating jobs and improving the welfare of society [3].

In Makassar, the number of MSMEs has significantly grown from 2019 to 2021, reaching 5,387 business units spread across 15 districts [4], [5]. This growth is in line with data from BPS (Statistics Indonesia) showing that 99.9% of business units in Indonesia are MSMEs [6]. In Sulawesi itself, MSMEs have also developed rapidly, such as in Manado, where they account for nearly 99% of total businesses. Specifically, in Makassar, data from 2023 shows there are about 19,000 MSMEs, with the culinary sector dominating with 5,000 units [7]. This fact indicates the high level of competition, especially in the culinary field.

The greatest challenge for MSMEs emerged after the Covid-19 pandemic. Data from the Ministry of Cooperatives recorded that 163,713 MSMEs were affected by the pandemic, particularly in the food and beverage sector [8]. This impact caused many businesses to experience financial difficulties, leading to large-scale layoffs [8], [9]. To address these challenges, the Makassar City Government has been supporting MSMEs through various programs, such as MSME Exposure and Digital Business by Diskominfo, as well as collaborations between the Cooperative Department and LPDB. These programs aim to strengthen synergy, open business opportunities, and help MSMEs adapt in the digital era.

Although the growth of MSMEs is quite high, only about 51% of culinary MSMEs in Makassar can survive for more than five years [10]. Most of those who survive are those who have utilized digital marketing strategies [11], [12]. However, not all MSMEs are able to transition to digital marketing due to limited knowledge of technology and

* Corresponding author:
E-mail address: valentino.aris@unm.ac.id



educational backgrounds [13]. Therefore, special strategies are needed to help culinary MSMEs compete in the digital era of Industry 4.0.

The implementation of digital marketing strategies is considered capable of increasing sales volume, expanding market share, and improving purchase intensity [14], [15]. Digital marketing enables communication and transactions to be carried out in real-time, easily accessible, and reaches a global market [16]. The shift from traditional marketing methods to digital marketing has become a trend, where business players now offer products more through digital platforms rather than conventional methods. This has made digital marketing one of the keys to MSMEs' success in the modern era [17].

In the context of culinary MSMEs in Makassar, the implementation of digital marketing can be analyzed using clustering methods to identify patterns in the use of digital marketing and their relationship to business revenue. Through this approach, researchers can provide a clear picture of the implementation of digital marketing, both for established MSMEs and new business owners. The research results are expected to provide practical information to help culinary MSMEs remain competitive, survive, and grow in an increasingly competitive digital era.

2. Method

This research uses a descriptive quantitative approach aimed at objectively describing the existing conditions using numerical data, from data collection to the analysis of the results. This research will be conducted at the Makassar MSME Incubator, which is a center for the development of micro, small, and medium businesses in Makassar. With a focus on culinary MSMEs within the incubation program, the study will be carried out for one month, from May 14 to June 14, 2024. The research design involves preprocessing data to process the information obtained and then analyzing the data using the K-Means algorithm for clustering, aiming to identify patterns in the data and generate structured groups.

The focus of this research is to analyze the digital marketing strategies implemented by culinary MSMEs in Makassar, particularly those in the incubation program. The research will identify popular digital marketing platforms such as social media, websites, and online food ordering applications, and evaluate their impact on increasing business revenue. Data collection techniques will be carried out through surveys using questionnaires distributed to respondents involved in the incubation program. Subsequently, the data will be analyzed using correlation and descriptive analysis techniques to determine the relationship between digital marketing usage and changes in revenue. Thus, this research is expected to provide valuable insights for culinary MSMEs in designing more effective digital marketing strategies.

3. Results and Discussion

3.1. Descriptive Analysis

In this study, data was obtained directly from a questionnaire given to 120 culinary MSMEs currently in the incubation phase at the Makassar City MSME Incubator. This research collects data covering various important elements related to culinary MSMEs in Makassar. The goal of this data description is to provide an overview of the characteristics of culinary MSMEs, particularly regarding business types, the year the business was established, and the duration of digital marketing usage (in years).

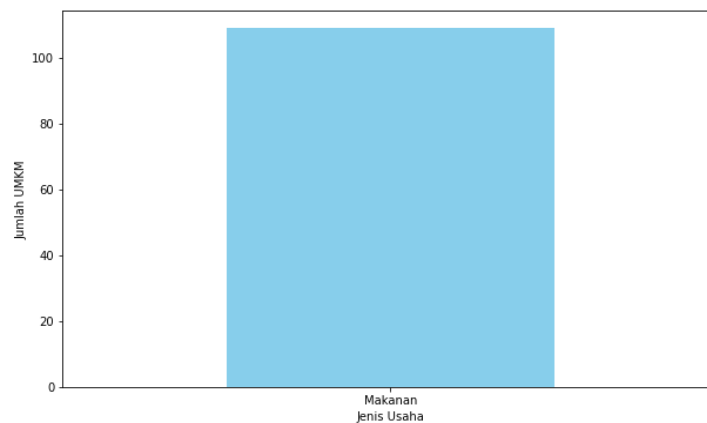


Fig.1. Number of Culinary MSMEs by Business Type

The **Fig. 1.** shows that the analysis of culinary MSMEs data in Makassar City, under the guidance of the Incubator, found that the food sector dominates significantly with a percentage of 90.83%. This dominance reflects the high consumer preference and the large market opportunities available in the food business sector. This phenomenon also indicates that the food sector is the main driver of the culinary industry in Makassar City, which directly contributes to increased revenue and MSME growth.

The significant increase in the number of MSMEs in the food sector can be attributed to several factors, including changes in consumer consumption patterns, the rising demand for ready-to-eat food products, and the various product innovations offered by business players in this sector. Additionally, the food sector has a strong appeal to MSME actors because it is relatively easy to access and can be adapted to local market preferences.

Therefore, focusing the analysis on the food sector becomes relevant and significant, considering its dominant contribution to the overall development of culinary MSMEs in Makassar City. This dominance provides a strategic direction for development and guidance programs conducted by the Incubator, emphasizing strengthening and developing the food sector to support sustainable growth.

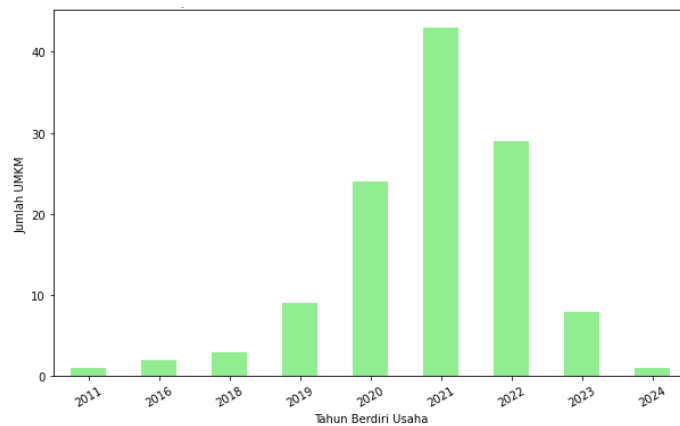


Fig. 2. Number of Culinary MSMEs by Year of Establishment

The **Fig. 2.** shows how the number of culinary MSMEs in Makassar City varies based on the year of establishment, illustrating the trend of culinary MSME formation over a certain period. From 2011 to 2018, the number of culinary MSMEs established was relatively low. However, in 2019, there was a significant increase, with 7.4% of culinary MSMEs being established in that year. The number of new culinary MSMEs continued to grow in 2021, reaching a percentage of 35.5%. In 2022, the number of new MSMEs remained high, although it slightly decreased compared to the previous year.

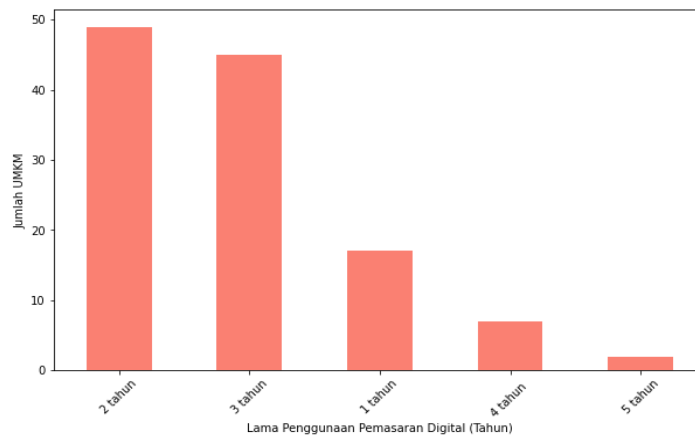


Fig.3. Duration of Digital Marketing Usage by Culinary MSMEs

The **Fig. 3.** illustrates that most culinary MSMEs in Makassar City have started utilizing digital marketing in recent years. The majority of culinary MSMEs have been using digital marketing for 2 years, with around 49 MSMEs. The

use of digital marketing for 3 years is also quite significant, with about 45 MSMEs. There are 17 culinary MSMEs that have been using digital marketing for 1 year, while the number drops to about 14 MSMEs that have been using it for 4 years. Only around 2 culinary MSMEs have been using digital marketing for 5 years. This data shows that the adoption of digital marketing by culinary MSMEs in Makassar City mostly started in the last 2 to 3 years.

3.2. Clustering Implementation

Clustering using the K-Means method. The data used includes 120 culinary MSMEs under the incubator that are still in the incubation stage. The purpose of this implementation is to identify clusters of digital marketing usage that are related to the revenue of culinary MSMEs.

Based on the figure above, the distribution of digital marketing usage and revenue in the histogram shows that the majority of culinary MSMEs use 2 to 4 digital marketing strategies. This indicates that most culinary MSMEs in Makassar City choose to use more than one social media platform to expand their marketing reach. On the right side of the graph, the monthly revenue of culinary MSMEs mostly ranges from IDR 1,000,000 to IDR 3,000,000.

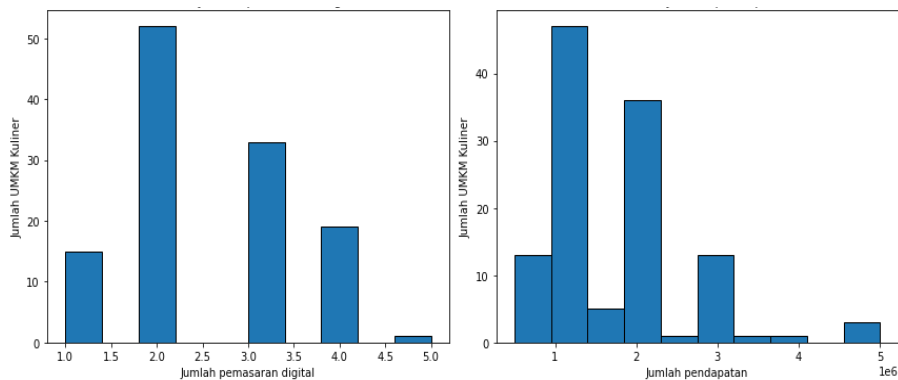


Fig. 4. Distribution of Digital Marketing Usage & Revenue

Fig. 5. shows data from 120 culinary MSMEs in Makassar City that are in the incubation stage in 2024. The data includes the number of digital marketing strategies, the digital marketing platforms used, and the monthly revenue of culinary MSMEs. It is observed that the most used digital marketing platforms by culinary MSMEs are 3 social media platforms: Instagram, with 93.33%; WhatsApp, with 77.5%; and Facebook, with 56.67%.

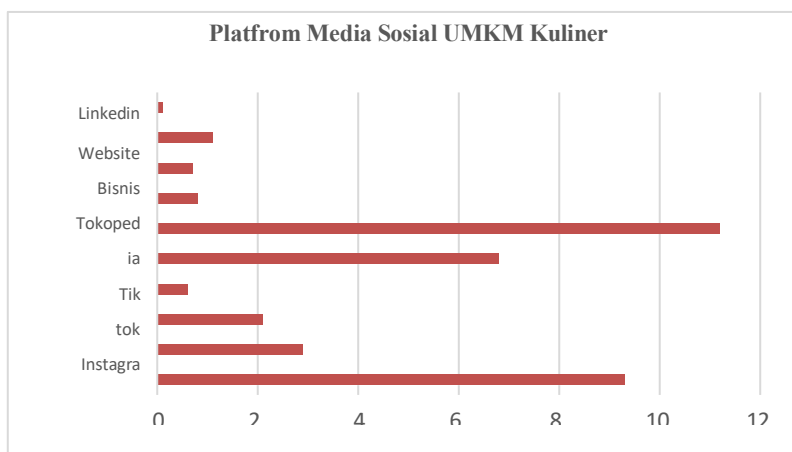


Fig. 5. Social Media Platforms Used by Culinary MSMEs

Fig. 6. displays culinary MSME data grouped into three distinct clusters based on the number of digital marketing strategies used and the revenue of culinary MSMEs. The cluster data consists of 29 MSMEs in Cluster 1, 49 MSMEs in Cluster 2, and 42 MSMEs in Cluster 3.

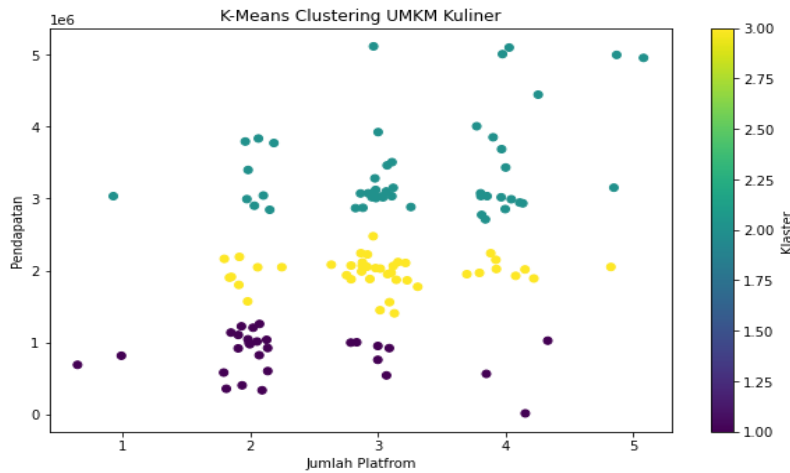


Fig. 6. K-Means Clustering of Culinary MSMEs

In Cluster 1 (Purple), this cluster consists of culinary MSMEs with a low number of digital marketing strategies, with an average of 1 to 4 social media platforms. In Cluster 1, the monthly revenue of these MSMEs ranges from IDR 500,000 to IDR 1,000,000. Cluster 2 (Green) includes 49 culinary MSMEs that use 1 to 5 digital marketing platforms but are dominated by 3 to 4 social media platforms. The revenue in Cluster 2 is higher compared to Cluster 1, ranging from IDR 3,000,000 to IDR 5,000,000. The lower number of marketing platforms tends to have lower income due to limitations or lack of knowledge about how to implement social media platforms in business development. Cluster 3 (Yellow) includes culinary MSMEs that use around 2 to 5 digital marketing platforms, with a medium income ranging from IDR 2,000,000.

3.3. Correlation Analysis

This study conducted a correlation analysis on data covering three main variables: the number of social media platforms, the number of social media posts, and the monthly revenue. The study performed the correlation analysis using Microsoft Excel's Analysis ToolPak to obtain results from the data analysis, which can be used as a reference to determine whether there is a relationship between the number of digital marketing strategies and monthly revenue of culinary MSMEs.

Table 1. Distribution of Social Media Platform Usage

Social Media Platform	Number of Platforms
WhatsApp	93
Facebook	68
Instagram	112
Gojek	29
Grab	21
Tiktok	8
Shopee	6
Business Website	11
Tokopedia	7
LinkedIn	1

The table above shows that the majority of culinary MSMEs in Makassar City that are in the incubation stage predominantly use the Instagram social media platform, with 112 users. This indicates that many culinary MSMEs are utilizing Instagram to promote their businesses. Additionally, WhatsApp and Facebook are also widely used, with 93 and 68 users respectively, reflecting that these platforms can be leveraged by culinary MSMEs in their digital marketing strategies. Platforms such as Gojek, Grab, TikTok, Shopee, Business Websites, Tokopedia, and LinkedIn have fewer users. This reflects that, although these platforms are not as popular as Instagram, WhatsApp, and Facebook, culinary MSMEs still make use of them according to their marketing needs and strategies. The use of social media platforms shows that culinary MSMEs in Makassar City are exploring various ways to enhance their presence and business performance in the digital world.

Table 2. Distribution of Culinary MSMEs by Revenue Range, Number of Social Media Platforms, and Number of Social Media Posts

Monthly Income Range (Rp)	Number of MSMEs	Average Number of Social Media Platforms	Number of Social Media Platforms	Number of Social Media Posts
500,000 - 1,062,500	29	2	68	893
1,062,500 - 1,625,000	3	3	8	39
1,625,001 - 2,187,500	37	3	117	3,310
2,187,501 - 2,750,000	1	3	3	6
2,750,001 - 3,312,500	33	3	104	5,321
3,312,501 - 3,875,000	4	4	14	824
3,875,001 - 4,437,500	7	2	19	3,070
4,437,501 - 5,000,000	6	4	25	1,454

Source: Processed Data (2025)

The Table 2 shows the variation in the use of social media platforms and the number of social media posts according to their monthly income range. Culinary MSMEs with monthly incomes ranging from IDR 500,000 to IDR 1,062,500 consist of 29 MSMEs, with an average use of 2 social media platforms, totaling 68 platforms, and producing 893 posts. This shows that MSMEs in this low-income group, although using fewer social media platforms, are quite active in posting.

Culinary MSMEs with monthly incomes ranging from IDR 1,062,500 to IDR 1,625,000 consist of 3 MSMEs using an average of 3 social media platforms, with a total of 8 platforms, and producing 39 posts. This group, although small, uses more social media platforms but is less active in posting. Culinary MSMEs with monthly incomes ranging from IDR 1,625,001 to IDR 2,187,500 consist of 37 MSMEs, with an average use of 3 social media platforms, totaling 117 platforms, and producing 3,310 posts.

In the income range of IDR 2,187,501 to IDR 2,750,000, there is 1 culinary MSME that uses 3 social media platforms, totaling 3 platforms, and produces 6 posts. Culinary MSMEs with monthly incomes ranging from IDR 2,750,001 to IDR 3,312,500 consist of 33 MSMEs, using an average of 3 social media platforms, with a total of 104 platforms, and producing 5,321 posts, showing high posting activity.

Culinary MSMEs with monthly incomes ranging from IDR 3,312,501 to IDR 3,875,000 consist of 4 MSMEs, using an average of 4 social media platforms, totaling 14 platforms, and producing 824 posts. Culinary MSMEs with monthly incomes ranging from IDR 3,875,001 to IDR 4,437,500 consist of 7 MSMEs, using an average of 2 social media platforms, totaling 19 platforms, and producing 3,070 posts. Finally, culinary MSMEs with monthly incomes ranging from IDR 4,437,501 to IDR 5,000,000 consist of 6 MSMEs, using an average of 4 social media platforms, totaling 25 platforms, and producing 1,454 posts.

Table 3. Correlation Analysis of Social Media Platform Numbers

	<i>Number of Social Media Platforms</i>	<i>Monthly Income (per month)</i>
Number of Social Media Platforms	1	
Monthly Income (per month)	0.432	1

Source: Processed Data (2025)

The results of the correlation analysis show a positive relationship between the number of social media platforms and the monthly revenue of culinary MSMEs. The correlation coefficient of 0.431 indicates a moderately strong relationship between the number of social media platforms used by culinary MSMEs and the monthly revenue generated. This suggests that utilizing various social media platforms simultaneously has the potential to positively impact the revenue of culinary MSMEs. However, the effectiveness of using these platforms also depends on the marketing strategies implemented by each culinary MSME.

Table 4. Correlation Analysis of Number of Social Media Posts

	<i>Number of social media posts</i>	<i>Amount of income (per month)</i>
Number of social media posts	1	
Amount of income (per month)	0.332	1

Source: Processed Data (2025)

The results of the correlation analysis in the table above between the number of social media posts and the monthly revenue of culinary MSMEs show a low correlation value of 0.331. This value indicates a moderate correlation between

the two variables. It means there is a significant relationship between the increase in the number of social media posts and the increase in the revenue of culinary MSMEs.

This correlation result shows that an increase in the number of social media posts tends to be followed by an increase in revenue. Although this relationship is not strong, it is sufficient to show that the number of social media posts plays an important role in influencing the revenue of culinary MSMEs. Therefore, increasing the number of social media posts could be an effective strategy to boost revenue, although it still needs to be supported by other more comprehensive marketing strategies.

3.4. Discussion

The implementation of clustering in this study aims to group culinary MSMEs based on patterns of digital marketing usage and monthly revenue. The K-Means method was used to separate culinary MSMEs into different groups based on similarities in the number of social media platforms used and the revenue generated. Clustering theory states that clustering helps identify homogeneous groups based on certain characteristics[18].

The clustering results show that the first cluster consists of culinary MSMEs with a low number of digital marketing platforms (1 to 4 social media platforms), which tend to have revenue ranging from IDR 500,000 to IDR 1,000,000. Meanwhile, the second cluster includes culinary MSMEs that use digital marketing with more than 1 to 5 social media platforms, predominantly 3 to 4 platforms, and generate higher revenue, ranging from IDR 3,000,000 to IDR 5,000,000. The third cluster consists of culinary MSMEs using 2 to 4 types of digital marketing, with a moderate revenue range of IDR 2,000,000.

The clustering results show that culinary MSMEs using more social media platforms tend to have higher revenue. This can be interpreted as the use of various social media platforms allowing culinary MSMEs to reach a wider and more diverse audience. Each social media platform has its own characteristics in terms of users. By utilizing multiple platforms, culinary MSMEs can optimize their marketing reach, attract customers from various market segments, and increase the potential for purchases or interactions that generate profit.

Through this grouping, more targeted recommendations can be made for new business owners and culinary MSMEs to improve their digital marketing strategies. Culinary MSMEs with low revenue can expand the use of social media platforms and be supported by effective strategies, engaging content, and good management to improve visibility and sales. On the other hand, culinary MSMEs with relatively higher revenue can consider maintaining or enhancing already effective marketing strategies to maximize profits from existing digital platforms.

Correlation analysis shows a relatively strong relationship, with a correlation coefficient of 0.431, between the number of social media platforms used by culinary MSMEs and their monthly revenue. This study is supported by other studies that show the effectiveness of digital marketing heavily depends on how these platforms are used. A previous study indicates that digital marketing adoption significantly enhances the sustainable growth of MSMEs, especially with the use of various digital platforms[19]. This study found that subjective norms and perceived behavioral control directly influence the actual use of digital marketing, which ultimately has a positive impact on MSME growth. This finding is also reinforced by previous research[20], which states that digital marketing innovation contributes to company performance by improving marketing capabilities and moderating company size.

The correlation analysis between the number of social media posts also shows a moderate positive relationship with a low correlation coefficient of 0.331 between the number of social media posts by culinary MSMEs and their revenue. This indicates that consistent posting activity can influence the increase in culinary MSMEs' revenue. Marketing strategies that prioritize consistency and relevance in content posting can increase consumer engagement and strengthen brand awareness.

The results of the correlation analysis provide a deeper understanding of the importance of digital marketing strategies for culinary MSMEs in Makassar City. By utilizing various social media platforms and planned posting activities, culinary MSMEs can enhance their visibility and consumer interaction, which can boost their revenue. Although the relationship between the number of social media platforms or posts and revenue is not causal, the significant correlation shows that investing in digital marketing can provide a positive impact.

Aside from the number of social media platforms and posts, other factors such as content quality, accurate market targeting, and managing interactions with consumers also play a crucial role in the success of digital marketing strategies. Therefore, culinary MSMEs need to continuously review and adapt their marketing strategies according to changing trends and market demands to maximize growth potential and business sustainability in an ever-evolving digital era.

Revenue of Culinary MSMEs in Makassar City is also influenced by various other factors. The quality of products, the number of social media posts, creativity in creating marketing content, and a good understanding of the target market play significant roles in determining the success of digital marketing strategies. Culinary MSMEs that can produce engaging and relevant content and effectively manage consumer interactions are more likely to experience significant revenue growth.

For new business owners and culinary MSMEs in Makassar City, this study highlights the importance of adopting effective digital marketing strategies. With the dominance of social media platforms like Instagram, WhatsApp, and Facebook in digital marketing usage, there is a great opportunity to reach a wider audience and increase brand exposure online. Business owners should consider integrating more social media platforms into their marketing strategies, in line with the increasing consumer shift to digital platforms.

The number of social media posts plays a vital role in marketing strategies. Active and regular posting not only increases business exposure to potential audiences but also strengthens interactions with existing customers. Studies show that consistency in publishing informative and engaging content can enhance engagement levels and brand awareness, which ultimately positively impacts sales and customer loyalty. By optimizing the number of social media posts, new business owners and culinary MSMEs can maximize the effectiveness of digital marketing campaigns, expand market reach, and build stronger relationships with consumers on platforms such as Instagram, WhatsApp, and Facebook.

Additionally, improving digital knowledge and skills through training and education on effective social media platform management can help culinary MSMEs optimize their investment in digital marketing. A previous study shows that digital training significantly enhances MSMEs' ability to use digital technologies for marketing, resulting in increased visibility and business growth. This finding aligns with the argument that training and education on social media platform management can help culinary MSMEs optimize their investment in digital marketing, thus enhancing their visibility and growth potential in an increasingly competitive market. This study supports the finding that increasing digital knowledge and skills through training can have a positive impact on the sustainability of MSME businesses in the digital era. This study provides clear insights for new business owners and culinary MSMEs in Makassar City to improve the effectiveness and impact of their digital marketing strategies, as well as to fully leverage the potential of technology to support business growth.

4. Conclusion

Based on the research results on the Implementation of the Clustering Method for Digital Marketing Data on Culinary MSME Revenue in Makassar City, the following conclusions can be drawn: (1) Clustering using the K-Means method successfully grouped culinary MSMEs based on the number of social media platforms used and business revenue. MSMEs using 2 to 4 social media platforms tend to have higher revenue, around IDR 3,000,000 to IDR 4,000,000, while those using 1 to 2 platforms have lower revenue. (2) The correlation analysis shows a significant positive relationship between the number of social media platforms used and revenue. Using platforms like Instagram, WhatsApp, and Facebook can help expand market reach and strengthen brand awareness. (3) The research also shows that using social media platforms effectively increases brand exposure, and training in the use of other platforms is essential to maximize digital marketing, improving visibility and business growth in a competitive market.

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