



SAW-GIS Analysis: Economic Potential of Batik MSME's in Surakarta

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Surakarta is the national center of the batik industry; however, its growth has not been supported by comprehensive spatial-economic mapping, resulting in overly general development policies. This study analyzes the economic potential of batik MSMEs in Surakarta using the Simple Additive Weighting (SAW) method and Geographic Information Systems (GIS). Unlike descriptive approaches, this study introduces a quantitative framework to measure potential based on three related variables: distance (accessibility), product completeness (competitive advantage), and price (market equilibrium). The SAW method is applied to determine development priority rankings. The results indicate that 53.7% of MSMEs fall into the high-priority category, 37% into the medium-priority category, and 9.3% into the low-priority category. These findings suggest that batik development in Surakarta requires differentiated strategies based on regional typologies. This study contributes to the development of a visual database and decision-support tools for local governments to formulate appropriate location-based empowerment programs. The integration of SAW and GIS provides a robust economic-spatial perspective, ensuring that development policies account for both geographical and competitive factors simultaneously. This approach offers practical contributions to MSME digitalization and regional economic planning, particularly for traditional industries transitioning into a digital ecosystem.

INTRODUCTION

Indonesia is a country with a rich and diverse cultural heritage that continues to be preserved today. According to Geçikli *et al.* (2024) and Reshma *et al.* (2023), cultural heritage refers to the legacy of past ways of life, the heritage experienced in the present, and the values that will be passed on to future generations, particularly those created by human communities as expressions of their way of life. Batik, an indigenous cultural heritage of the Indonesian people, has gained international recognition and has been acknowledged by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as an Intangible Cultural Heritage of Humanity. Batik features unique combinations of motifs inspired by the regions where it is produced. It is an art form that involves drawing repeated patterns on fabric using a canting tool (Gede *et al.*, 2022).

However, most well-known batik centers are currently located in Central Java and Yogyakarta (Imihezri *et al.*, 2021). One of these centers is Surakarta City, which has significant potential for batik development, production, and trade, making it a national flagship product that has successfully entered global export markets (Hastuti *et al.*, 2021). The contribution of batik as a creative industry to Indonesia's economic and socio-cultural development cannot be overlooked. The majority of batik artisans and producers in Indonesia operate as home-based businesses and MSMEs (Micro, Small, and Medium Enterprises) (Jones, 2018).

One of the key sectors supporting Surakarta's economy is micro, small, and medium enterprises (MSMEs). This is reflected in the significant growth in the number of business units. The Surakarta City Cooperative, SME, and Industry Agency reported that the number of MSMEs reached 11,157 in 2022, a substantial increase from 3,635 units in 2021. This figure consists of microenterprises (11,138), small enterprises (18), and medium enterprises (3). However, this increase in quantity does not necessarily indicate improvements in quality and competitiveness. Although previous research

(Prasetyo, 2019) shows that culture-based entrepreneurship positively influences economic development, the batik sector in Surakarta continues to face structural pressures, particularly as production costs increase faster than consumer purchasing power (Ratna Sari & Hendra Setiawan, 2015a).

The entrepreneurial orientation of business actors further complicates this challenge, as many still rely on traditional marketing methods that depend heavily on physical visits from tourists through showrooms. In the era of the Fourth Industrial Revolution, this dependency creates significant risks amid increasingly intense competition with regions that have already adopted technology extensively (Hastuti *et al.*, 2021). According to the Surakarta city government (2023), structural barriers, including limited capital, supply chain constraints, and low technological adoption, indicate that MSME development cannot be implemented using a uniform approach.

To date, studies on batik MSMEs in Surakarta have predominantly focused on internal managerial perspectives, emphasizing factors such as capital, human resources, and financial performance (Ratna Sari & Hendra Setiawan, 2015; Denora & Riyanto, 2021). Although recent spatial studies conducted by Bidari *et al.* (2025) have examined industry interaction patterns, their approach remains primarily descriptive and qualitative. Without a quantitative-spatial approach, efforts to prioritize MSME development in Surakarta may lack the precision required for spatially targeted policy interventions. Furthermore, research integrating decision-making analysis using SAW and geospatial data (GIS) to evaluate economic potential quantitatively remains limited. Although Taufik and Justian (2019) applied GIS and SAW methods to batik MSMEs in Surabaya, similar studies in Surakarta that comprehensively integrate spatial variation with economic indicators remain scarce. Therefore, the novelty of this research lies in addressing this gap by combining criteria-based economic potential evaluation (SAW) with spatial visualization (GIS) within the Surakarta batik ecosystem.

In assessing the potential of batik MSMEs, this study integrates three main theoretical foundations. First, the accessibility concept proposed by Geurs and van Wee (2004) is used to measure the ease of reaching business locations, with distance as the primary variable. Second, the product-completeness theory developed by Kotler and Keller (2012) is applied to examine how product diversity influences consumer decision-making. Third, Marshall's (1890) price theory is used to examine the relationship between production costs and consumer purchasing power. The integration of these three variables within the Simple Additive Weighting (SAW) method enables a more comprehensive assessment of economic potential by considering not only internal business factors but also market and spatial interaction aspects.

The integration of variables in this study is based on the assumption that accessibility determines market reach. At the same time, product variety and competitive pricing serve as key drivers of consumer decision-making. Theoretically, locations with high accessibility but limited product diversity may struggle to optimize their economic potential. Therefore, this study proposes that the synergy between geographical accessibility and product price competitiveness represents an important factor influencing MSME sustainability in Surakarta.

Therefore, this research applies the Simple Additive Weighting (SAW) and Geographic Information System (GIS) methods to provide a more precise evaluation of the potential of batik MSMEs. The use of distance, product completeness, and price variables in this model is essential for representing market accessibility and competitive advantage. Through this spatial mapping approach, future MSME development strategies can be formulated with greater precision, objectivity, and alignment with regional priorities. In the post-pandemic digital era, understanding these spatial dynamics is increasingly important. MSMEs that fail to optimize their geographic accessibility and

product competitiveness may struggle to maintain competitiveness in an increasingly integrated market.

RESEARCH METHODS

This study employs a quantitative approach using primary data collected through a survey of batik MSME owners in Surakarta. The respondents consisted of 54 batik business owners operating in four major trading centers: Pasar Klewer, Solo Wholesale Center (PGS), Beteng Trade Center (BTC), and Batik Cindramata Market. This study focuses on assessing business potential; therefore, the sample size must adequately represent variations in location and trader characteristics within the study area.

Sample representativeness is essential for accurately analyzing and visualizing spatial distribution (Riffith, 2013; Hennink and Kaiser, 2022). Based on these considerations, the 54 respondents are considered sufficient and valid for analysis because they represent the distribution of traders across the four main batik trading centers in Surakarta City, providing a comprehensive representation of the empirical conditions of batik MSMEs.

Data were collected through direct interviews and MSME location plotting to assess the potential of batik MSMEs based on three criteria: location accessibility, price, and product variety. The sampling technique used in this study was convenience sampling, where respondents were selected based on their availability and willingness to participate during two weeks of intensive field observation. For the small number of respondents whose stores were closed during the field survey, price data were estimated based on cross-sectional prices observed at similar stores in the same neighborhood to ensure data continuity. This approach was adopted to accommodate the high level of commercial activity at the study sites while ensuring that data collection did not disrupt respondents' business operations.

The SAW method was selected because it provides an objective and systematic assessment of multiple alternatives based on predetermined criteria. In this study, each batik MSME is considered an alternative, while the evaluation criteria include accessibility, location, price, and product variety. The SAW analysis consists of four stages: (1) determining the criteria and their importance weights, (2) constructing the decision matrix, (3) normalizing the decision matrix based on the attribute type, and (4) calculating preference values to determine the potential ranking of batik MSMEs. The results of the SAW analysis are used to identify MSMEs with the highest potential in each trading center, thereby providing a basis for developing more targeted strategies and policy recommendations.

The software used is ArcGIS. This study uses a Geographic Information System (GIS) because it can integrate various types of data related to geographic locations into a single system and present them in visual formats such as maps, graphs, and tables. Using GIS, the locations and characteristics of MSMEs can be displayed spatially, facilitating the visual analysis of the distribution of batik MSMEs in Surakarta (Abdullah *et al.*, 2018). The GIS analysis stages include: (1) creating a 1:5000 digital map of the city of Surakarta (2) plotting the locations of MSMEs (3) interviewing MSME owners (4) creating a GIS of batik MSMEs in Surakarta (5) scoring analysis using the SAW method (6)

analyzing the potential of batik MSMEs in Surakarta (6) creating a map of the potential of batik MSMEs in Surakarta.

Table 1. Criteria Weight

Parameters	Weight
Transportation Access Distance (TAD)	0,334
Price (P)	0,334
Product Type (PT)	0,334
Total	1,000

Source : Data Processed (2025)

Before analyzing the results, the criteria weights were determined, as presented in Table 1. The assessment of batik MSME potential in Surakarta City was based on three main criteria: transportation access distance, price, and product type. Each criterion was assigned an equal weight of [insert value], resulting in a total weight of 1. The equal weighting approach ensures that each criterion has equal importance in the decision-making process, preventing any single aspect from dominating the final assessment of MSME potential. This approach is relevant because accessibility, price affordability, and product diversity are complementary factors that influence MSME competitiveness and sustainability. With a balanced weighting structure, the SAW method provides a more objective and comprehensive evaluation of MSME potential.

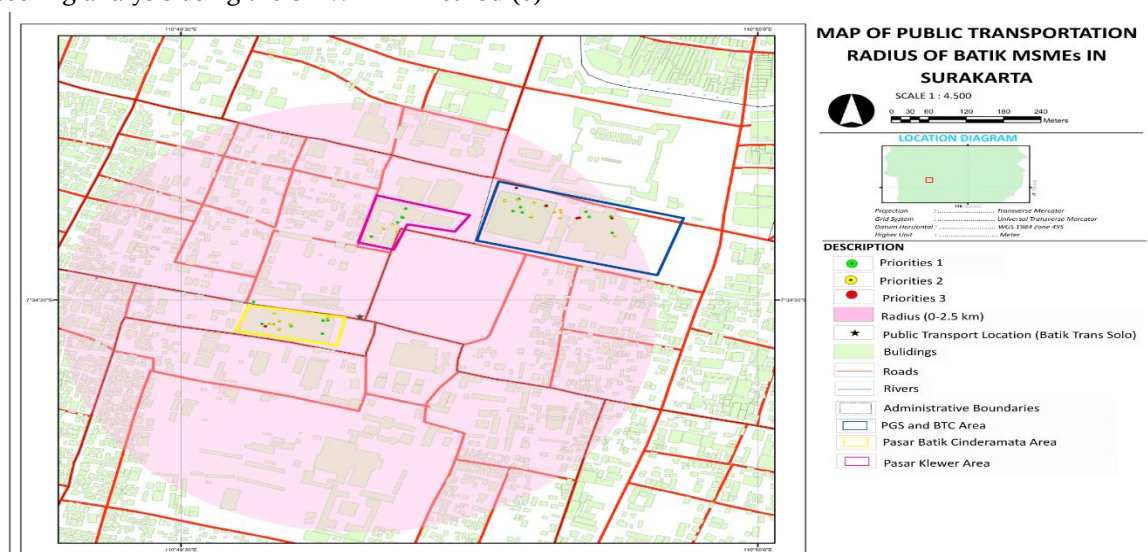


Figure 1. Map of Public Transportation Radius of Batik MSMEs in Surakarta

Based on Figure 1, the four MSME batik markets in Surakarta are within a 2.5 km radius of the Solo Trans Bus (BST), indicating high potential for MSME development, as proximity

to public transportation can increase visitor numbers, ease distribution, and improve mobility efficiency.

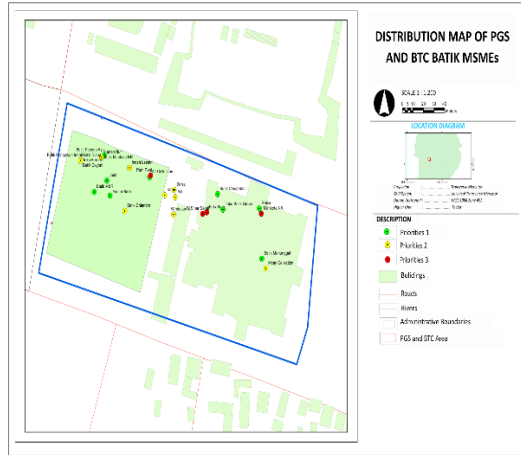


Figure 2a. Distribution Map of PGS and BTC Batik MSMEs

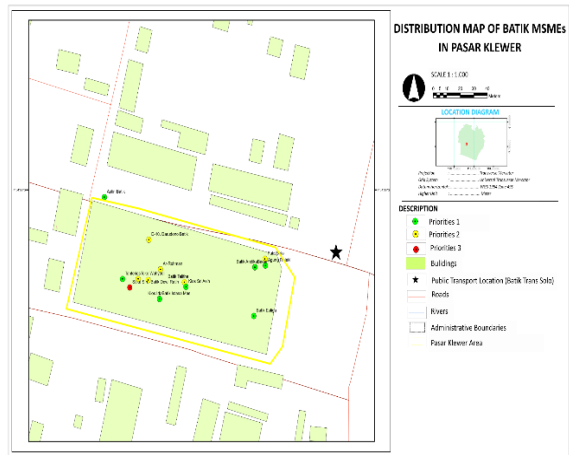


Figure 2b. Distribution Map of Batik MSMEs in Pasar Klewer

Based on the distribution map of batik MSMEs in Pasar Klewer, PGS, and BTC presented in Figures 2a and 2b, MSMEs across high-, medium-, and low-priority categories do not form distinct spatial clusters but are relatively evenly distributed throughout the market areas. This distribution pattern indicates that batik

MSME activities are not concentrated in a single location but instead follow the existing arrangement of trading spaces. The dispersed pattern suggests that each market area has relatively balanced economic potential and similar levels of consumer accessibility.

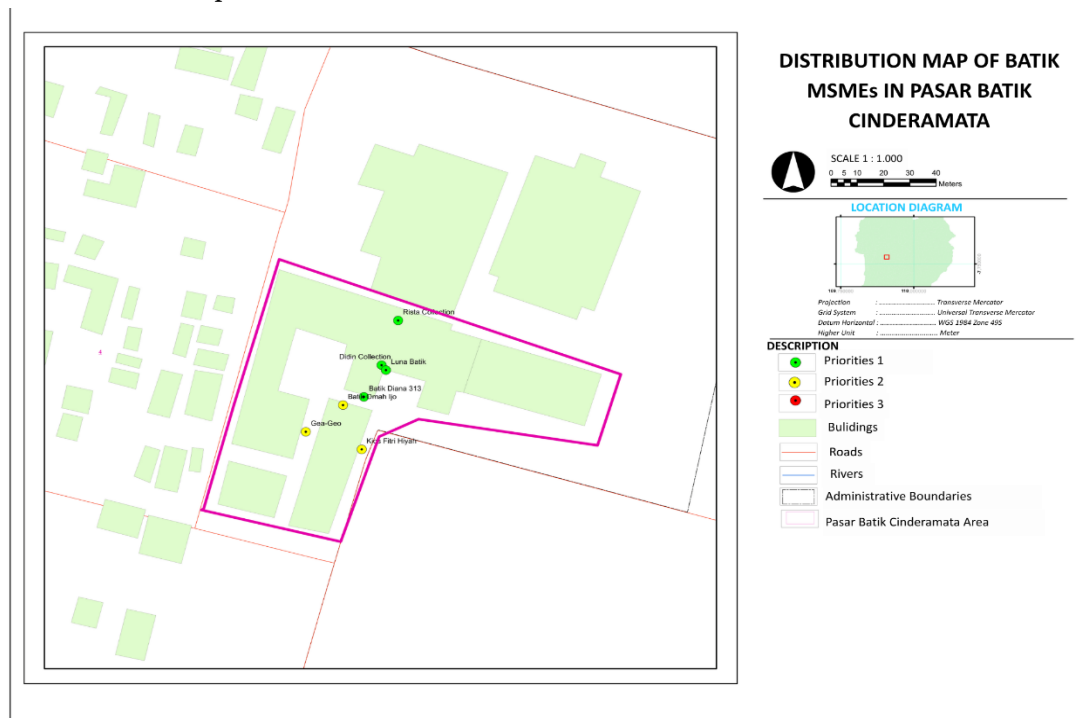


Figure 3. Distribution Map of Batik MSMEs in Pasar Batik Cindramata

Unlike other markets, the distribution map of MSMEs in the Pasar Batik Cinderamata shows a clustered pattern, as indicated by the concentration of high- and medium-priority groups within the same area. The concentration of MSMEs in specific locations suggests the presence of a more centralized hub of batik trading activities. This cluster pattern indicates the potential to develop the area as a center for batik MSMEs, supported by stronger interactions among business actors and easier access for consumer engagement.

RESULTS AND DISCUSSION

The use of convenience sampling was considered appropriate for this study because the research aimed to conduct spatial mapping and potential assessment across established batik trading centers. Although the sample size was limited to 54 respondents, the distribution shows a representative spatial pattern across the four main batik hubs, an important prerequisite for GIS analysis.

Table 2. Characteristics of Batik MSMEs Respondents in Surakarta (n=54)

Characteristics	Category	Number
Business Location	Pasar Klewer	20
	Pusat Grosir Solo (PGS)	17
	Beteng Trade Center (BTC)	10
	Pasar Batik Cinderamata	7
Product Segmentation	Adult batik	Dominant
	Adult batik and children	Dominant
	Batik Cloth	Partial
Product Form	Ready-made batik clothing	Majority
	Batik cloth	Significant
	Batik complementary products	Limited
Price range	< Rp50.000	Limited
	Rp50.000–Rp300.000	Majority
	> Rp300.000	Limited

Description: Dominant = >50%, Majority = 40%-50%, Partial = 20% - <40%, and Limited <20%

Source: Data Processed, 2026

The characteristics of the respondents (n = 54) indicate that businesses are predominantly concentrated in major commercial areas, such as Pasar Klewer and PGS. Ready-to-wear batik products dominate the price range of Rp 50,000–Rp 300,000, suggesting that batik MSMEs in Surakarta primarily target the middle market, emphasizing affordable, ready-to-wear products. This finding aligns with Surakarta's position as a national center for batik wholesale activities.

Transportation access distance is a key indicator in measuring the accessibility of batik MSME locations and is a cost criterion category. The results of the study shown in Table 3 explain that all MSME respondents are within a 0-3 km radius of transportation access. This finding

indicates that batik MSMEs in four markets in Surakarta City have very good accessibility. The proximity of the location to transportation routes provides various strategic advantages, such as ease of consumer access to the business, improved efficiency in goods distribution, and reduced costs and travel time

Table 3. Distance of MSMEs from Access of Transportation

Transportation Access Distance	Scores	Number of MSMEs	Percentage
0–3 km	15	54	100%
3–6 km	10	0	0%
> 6 km	5	0	0%

Source: Data Processed (2025)

In the context of the batik market functioning as a shopping destination for tourists, high accessibility can increase visitor traffic and sales volume. Therefore, these results indicate

that location is one of the main advantages of batik MSMEs in Surakarta in supporting business sustainability and performance.

Table 4. Distribution of Batik MSMEs Price Ranges

Price range	Classes	Score	Number of MSMEs	Percentage
Rp10.000–Rp100.000	Economical	9	14	25,9%
Rp100.001–Rp250.000	Lower-middle class	7	32	59,3%
Rp250.001–Rp500.000	Middle class	5	6	11,1%
Rp500.001–Rp1.000.000	Upper-middle class	3	1	1,9%
> Rp1.000.000	Upper class	1	1	1,9%

Source: Data Processed (2025)

The price variable in this study includes the cost category, meaning that the lower the price range set by MSMEs, the higher the potential value. The results of the analysis in Table 4 shows that most batik MSMEs in Surakarta are in the price range of IDR 100,001-250,000, which is categorized as lower-middle class. This condition shows that the market orientation of batik MSMEs is more aimed at middle-class consumers, both tourists and local buyers.

Table 5. Variations in Types of Batik MSMEs Products

Type Product	Scores	Number of MSMEs	Percentage
Adults, children, cloth/accessories	3	6	12%
Combine two types of products	2	24	44%
Adult batik only	1	24	44%

Source: Data Processed, 2025

MSMEs with affordable and mid-range prices demonstrate competitive pricing strategies, especially amid competition among businesses in batik trading centers. Meanwhile, only a small number of MSMEs in the upper-mid and upper price ranges generally offer products with higher added value. Overall, this pricing structure shows that price is a strategic potential that supports the affordability of batik products while expanding the MSME market segment in Surakarta.

The products fall into the benefit category; the more diverse the product offerings, the higher the potential value of MSMEs. The results of the analysis in Table 5 show that most batik MSMEs offer one main product type, namely adult batik, or a limited combination of two types, such as adult and children's batik or adult batik and fabric. MSMEs that offer the most complete variety of products, such as adult batik, children's batik, fabric, or accessories, are still few in number. However, product variety can expand market segments, reduce dependence on a single product type, and increase business flexibility in the face of changing consumer preferences. Therefore, product types should be developed through innovation and product development based on market trends.

Table 6. Results of the Priority Classification of Batik MSMEs Potential

Priorities	Scores Range	Number of MSMEs	Percentage
Priority 1	0,80–0,89	29	53,7%
Priority 2	0,70–0,79	20	37,0%
Priority 3	0,50–0,69	5	9,3%

Source: Data Processed, 2025

Based on the Simple Additive Weighting (SAW) calculations presented in Table 6, batik MSMEs in Surakarta are classified into three priority levels based on their potential. The findings indicate that the majority of MSMEs (more than half of the respondents) are categorized as Priority 1, reflecting a strong combination of location accessibility,

competitive pricing, and product variety. Several MSMEs are classified as Priority 2, with strengths concentrated in certain areas but limited in others, such as product diversification. Meanwhile, the small proportion of MSMEs categorized as Priority 3 suggests that most batik MSMEs in Surakarta demonstrate relatively strong potential.

The application of the SAW method enables an objective and integrated assessment of MSME potential by considering all three criteria simultaneously. The results show that batik MSMEs in Surakarta City generally demonstrate strong potential, particularly in terms of accessibility, pricing, and product variety. Regarding accessibility, all respondent MSMEs are within a 0–3 km radius of major transportation hubs, indicating high accessibility to them. This condition represents a structural advantage for batik MSMEs in Surakarta's trade centers, as it may increase consumer traffic, improve distribution efficiency, and expand market exposure. However, the relatively uniform accessibility conditions also indicate that location factors have not yet become a major differentiator of competitiveness among MSMEs.

Based on the assessment results, the distance-to-transportation-access variable shows relatively uniform values across most MSMEs, making it less influential as a distinguishing factor in determining potential. This condition aligns with the concept of accessibility proposed by Geurs and van Wee (2004), which uses distance as an indicator of ease of reaching a location. However, its influence depends strongly on the spatial context of the research area. These findings support the argument that proximity to transportation hubs can reduce transaction costs and enhance MSME competitiveness within clustered market environments. Therefore, although location accessibility plays an important role, it serves as a supporting factor that interacts with other economic variables to shape MSME potential.

Regarding price, the dominance of the Rp100,001–Rp250,000 price range indicates a strong orientation toward the middle market.

This strategy reflects MSMEs' efforts to adapt to consumer purchasing power while also indicating limited penetration into higher-value market segments. The analysis shows that the price variable influences batik MSME potential, with more affordable products tending to achieve higher potential scores. This finding is consistent with Marshall's price theory (Marshall, 1890), which explains that the interaction between supply and demand influences price formation, suggesting that affordability plays an important role in attracting consumers with broader purchasing power. Furthermore, this finding supports the concept of price-based competition, in which affordability helps maintain market competitiveness and consumer loyalty. However, price alone does not determine MSME potential, as other factors, such as product variety and location accessibility, must support it. Meanwhile, product variety remains relatively limited, with most MSMEs offering adult batik products or only a small selection of product categories. This limited diversification indicates that product innovation has not been fully optimized as a strategy for differentiation and business risk mitigation. MSMEs with broader product variations have greater opportunities to reach different market segments, including tourists and niche consumers. Product completeness contributes positively to batik MSME potential, as businesses with more diverse product offerings tend to achieve higher potential values. This finding aligns with Kotler and Keller (2012), who emphasized that product completeness can increase business attractiveness and influence consumer purchasing decisions. The positive relationship between product diversity and MSME potential suggests that diversification can serve as a strategic mechanism to improve market resilience. However, product completeness remains a complementary factor rather than the sole determinant of MSME potential.

The SAW ranking results indicate that more than half of MSMEs are categorized as high priority, while the remaining MSMEs fall into medium- and low-priority categories. These findings suggest that differences in MSME

potential are not determined solely by location but are also influenced by pricing strategies and product diversification capabilities. Spatial analysis of the four batik MSME markets in Surakarta City, namely Pasar Klewer, PGS, BTC, and Pasar Batik Cideramata, shows that all markets are located within a 2.5 km radius and therefore have relatively good transportation accessibility. This condition demonstrates that the research area has strong potential for batik MSME development, supported by available transportation infrastructure.

However, MSME distribution patterns differ across markets. Pasar Klewer, PGS, and BTC exhibit a dispersed distribution, with no clear clustering by priority level. This pattern indicates that MSME activities are relatively evenly distributed across market areas rather than concentrated in specific locations.

In contrast, the Pasar Batik Cideramata demonstrates a clustered distribution pattern. This pattern indicates a more concentrated center of batik trading activity, suggesting the potential to develop into a specialized batik MSME hub. Differences in spatial patterns across markets indicate that although transportation accessibility is relatively similar across locations, non-spatial factors such as price and product completeness, analyzed through the SAW method, also influence MSME priority levels and distribution patterns.

Based on the spatial analysis, MSMEs with high economic priority are relatively evenly distributed throughout the research area. This indicates that economic potential is not concentrated in a single location, suggesting that MSME development policies should not focus solely on a single area. Instead, local economic development strategies should emphasize strengthening overall business capacity to encourage more inclusive economic growth.

CONCLUSION

Given the increasing structural pressures and digital competition within the creative industry, an assessment of the economic potential of batik MSMEs in Surakarta is essential to ensure their long-term sustainability.

This study aims to quantitatively evaluate the competitive advantages and spatial distribution of batik MSMEs by integrating Geographic Information Systems (GIS) and the Simple Additive Weighting (SAW) method, focusing on three key indicators: accessibility, product diversity, and price competitiveness.

This study successfully evaluates the potential of batik MSMEs in Surakarta through an integrated GIS–SAW approach. The results show that the majority of batik MSMEs located in major trading centers, including Pasar Klewer, Solo Wholesale Center (PGS), Beteng Trade Center (BTC), and Pasar Batik Cideramata, demonstrate relatively high economic potential. Specifically, 53.7% of MSMEs are classified as high-priority, 37% as medium-priority, and 9.3% as low-priority. Accessibility represents a major competitive advantage, as all observed MSME locations are within the service coverage area of Batik Solo Trans (BST), indicating strong connectivity to public transportation networks. Meanwhile, variations in product diversity highlight the need for further diversification strategies to strengthen market competitiveness.

From a spatial perspective, MSME distribution patterns vary across trading centers. MSMEs in Pasar Klewer, PGS, and BTC tend to exhibit a dispersed distribution pattern, suggesting relatively even economic activity across the commercial areas. In contrast, Pasar Batik Cideramata exhibits a clustered distribution pattern, suggesting the emergence of a more concentrated center of batik trading activity. These findings demonstrate that both spatial and non-spatial factors simultaneously influence the optimization of MSME potential.

The policy implications of this study emphasize the important role of local governments in strengthening the competitiveness of batik MSMEs through more targeted interventions. Development policies should not only focus on maintaining strategic business locations but also support product innovation, diversification, and the development of value-added market segments. Furthermore, MSME empowerment programs should consider differences in spatial characteristics and business

capabilities to ensure more effective resource allocation.

Although this study provides valuable insights into the economic potential of major batik trading clusters in Surakarta, further research should expand the analysis to suburban areas and involve larger sample sizes. Such extensions would provide a more comprehensive understanding of the broader economic dynamics, spatial interactions, and development challenges within the Surakarta batik industry.

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