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A Hybrid SOAR-BSC-AHP Framework for Strategy Selection in Digital Cultural Tourism

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Abstract

Digital transformation in cultural tourism presents significant challenges, particularly in heritage villages like Kotagede, Yogyakarta. Problems such as limited infrastructure, low digital literacy, and the absence of a structured planning framework hinder progress toward community-based sustainable tourism development. This study addresses these challenges by proposing an integrated decision-making framework that combines SOAR analysis, the Balanced Scorecard (BSC), and the Analytic Hierarchy Process (AHP). The SOAR-BSC framework captures strategic objectives from qualitative data through focus group discussions and stakeholder interviews, while the AHP quantitatively prioritizes eight strategic alternatives based on hierarchical criteria and subcriteria. The most impactful strategies identified were: (1) developing partnerships with tour operators, and (2) promoting community cultural education and training. The Learning and Growth Perspective emerged as the most influential factor (weight = 0.5549), highlighting the importance of community empowerment and digital skills development. Sensitivity analysis and cross-validation using the Simple Additive Weighting (SAW) method confirmed the consistency and robustness of the rankings. In practice, this framework offers a participatory, data-driven guide for digital transformation in heritage tourism, supporting not only improved destination management but also long-term cultural preservation through inclusive digital initiatives.

Keywords : *Analytic Hierarchy Process, Balanced Scorecard, Cultural Tourism, SOAR Analysis.*

1. INTRODUCTION

Cultural tourism is a strategic sector in Indonesia's economic development and preservation of cultural heritage. With the diversity of local history and traditions, cultural tourism destinations strengthen national identity and open up economic opportunities through the creative economy sector. Along with the development of the digital era, the use of information and communication technology (ICT) is crucial in increasing competitiveness, operational efficiency, and the quality of tourist experience through interactive media and data-based services [1] [2].

The integration of ICT in managing cultural destinations not only encourages wider promotion but also enriches historical narratives in an immersive manner and expands community participation in preserving local culture [3]. However, digitalizing tourism, especially in community-based areas, still faces serious challenges, such as limited resources, low digital literacy, and a structured and contextual digitalization strategy [4],[5]. On the other hand, the behavior of increasingly digital-savvy tourists demands adjustments to promotional strategies and tourism services based on digital platforms [6], including social media use and mobile technology integration [7].

Digital transformation has become a significant catalyst in developing various sectors, including tourism. In an era when information technology has penetrated almost all aspects of life, digital integration in managing tourist destinations is no longer just an option but a strategic necessity. In cultural tourism, digitalization increases the efficiency of promotion and services. It strengthens the

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
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preservation of local values through interactive media that reach across generations and regions [8]. Various studies have shown that digitalization can expand markets and support inclusive development, especially in community-based destinations. A study by [4] emphasized that digitalization in remote areas bridges access limitations and strengthens community welfare. However, the application of technology must consider the local socio-cultural context so that the strategies developed are technically efficient and culturally relevant.

One relevant case study is Kotagede Tourism Village in Yogyakarta. Kotagede, as the former capital of the Islamic Kingdom of Mataram and a center of silver craftsmanship, is a culturally rich yet under-digitized destination with a strong tradition of community conservation, making it an ideal location for participatory research on digital transformation. However, digital promotion and service strategies in this area are still limited. There are no tourism applications, interactive maps, or e-commerce systems for cultural products, which impact the destination's low visibility and its contribution to the local economy [9]. Previous studies have shown that integrating digital media and official websites can increase the effectiveness of the promotion and accessibility of tourism information [10]. Several other destinations, such as Bali and Lombok, have successfully integrated ICT for digital promotion, services, and marketing of cultural products [11].

To overcome these challenges, a digital transformation strategy framework that is both technologically efficient and socially and culturally relevant is needed. The Balanced Scorecard (BSC) approach is appropriate because it can formulate strategies based on four main perspectives: financial, customer, internal processes, and learning and growth [12]. To strengthen the participatory approach and local potential, SOAR (Strengths, Opportunities, Aspirations, Results) analysis is used as the basis for community-based strategy formulation [13]. We then evaluate the results of the SOAR-BSC strategy mapping using the Analytic Hierarchy Process (AHP) method, an objective and structured multi-criteria decision-making tool. While prior research has explored individual use of BSC, SOAR, or AHP in tourism or public sector planning, very few studies have integrated all three into a unified, participatory model for digital transformation in cultural heritage destinations.

A structured and adaptive strategic planning framework is needed to answer these needs. BSC, introduced by Kaplan and Norton, is one of the most widely used approaches in formulating long-term strategies. This framework divides strategies into four main perspectives: financial, customer, internal processes, and learning and growth [12]. Various studies have demonstrated that the BSC systematically aligns organizational vision with strategic actions. However, the BSC approach is often considered too normative if not combined with a more participatory framework. Researchers developed SOAR to complement strategic analysis by emphasizing the community's positive potential and collective aspirations [13]. This approach is suitable for application in community-based cultural tourism destinations because it encourages active involvement in the strategy formulation process.

Furthermore, a quantitative method is needed to prioritize strategies objectively and measurably. AHP is one of the multi-criteria decision-making methods commonly used in strategic planning. AHP allows the evaluation of alternative strategies based on criteria and sub-criteria hierarchically through a pairwise comparison process.

Researchers have widely applied the integration of BSC and AHP in the manufacturing and public service sectors. However, its application in community-based cultural tourism remains limited. A study by [14]on water tourism management in Umbul Ponggok, for example, underlines the role of digital partnerships in attracting tourists but has not yet reached the depth of local cultural values. Meanwhile, the local wisdom approach in tourism development, such as that in Banyumas [15], has not been systematically integrated with digital strategies. Several other studies have adopted BSC to assess the performance of Micro, Small, and Medium Enterprises (MSME) around tourist areas, such as that carried out in Lombang Beach [16], but do not explicitly link the strategy to the use of information

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
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technology. A study by Singgalen [17] using Ward and Peppard Framework on hotel information system planning also emphasizes internal efficiency rather than strengthening cultural preservation through digitalization.

Previous research has primarily focused on performance assessment, internal systems, or digital marketing, neglecting the interconnections between cultural relevance, community engagement, and strategic priorities within an integrated framework. While SOAR, BSC, or AHP have been applied individually in tourism and public planning, there is a lack of research integrating the three into an integrated community-based model tailored to cultural destinations. This research gap has practical implications: a comprehensive approach combining SOAR, Balanced Scorecard, and AHP methods is lacking in the context of community-based digital transformation of cultural destinations. Our research aims to address this deficiency by proposing a hybrid model that is both strategic and participatory, and quantitatively accountable, thereby offering practical solutions to the challenges facing heritage tourism governance. This research addresses that gap by developing a hybrid SOAR–BSC–AHP framework tailored to Kotagede's unique challenges. It aims to (1) formulate digital transformation strategies that reflect community values and (2) prioritize these strategies based on quantifiable criteria. This study provides a hybrid strategic planning framework that combines participatory analysis and multi-criteria assessment, offering a replicable model for sustainable digital governance in heritage tourism.

2. METHOD

This research is descriptive explorative with a mixed methods approach, consisting of two main stages:

- The qualitative stage focused on identifying and formulating strategic alternatives using the SOAR framework and BSC. This framework was employed to gather contextual information, stakeholder aspirations, and relevant evaluation criteria through participatory methods, including focus group discussions (FGDs) and in-depth interviews with local stakeholders, who are key community members and leaders with a vested interest in the digital transformation strategy.
- The quantitative stage involved the systematic evaluation and prioritization of the formulated strategies using the Analytic Hierarchy Process (AHP). AHP is a decision-making tool that uses a mathematical model to analyze complex decisions. This stage transformed the qualitative assessments into measurable comparisons, allowing for the ranking of alternatives based on criteria and subcriteria derived from an adapted BSC perspective.

The methodological cycle follows five key stages as shown in Figure 1.

Figure 1. Research Stages

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
https://jutif.if.unsoed.ac.id
DOI: https://doi.org/10.52436/1.jutif.2025.6.4.4886

2.1. Vision Definition

This study formulates the vision through a participatory process involving various local stakeholders via Focus Group Discussions (FGDs) and in-depth interviews. This process not only aims to identify strengths and opportunities but also explore the community's collective hopes for the future of Kotagede as a cultural area. In the discussion, community actors, tourism managers, MSME actors, and cultural preservation institutions conveyed the importance of maintaining local identity while encouraging inclusive and sustainable economic transformation.

The stakeholders agreed upon a shared vision through this process: "Kotagede 2030: A Sustainable Cultural Tourism Destination that Drives the Community Economy."

This vision is a statement of future direction. It serves as a strategic reference framework for compiling all planning elements, especially in the strategy formulation process through the SOAR approach. In this study, each dimension in the SOAR analysis—Strengths, Opportunities, Aspirations, and Results—is formulated and mapped to this vision to ensure alignment with the community's collective ideals. By making the vision a starting point, the formulated strategy is responsive to current conditions and proactive in directing Kotagede's transformation towards a sustainable, culture-based future that empowers the community in a real way.

2.2. SOAR Analysis

Table 1. Alternatives (strategies) for AHP obtained from SOAR.

	Opportunities	**Results**
	• Collaboration with tourism operators • Government and investor support • The existence of a community-based and digital tourism ecosystem	• Increased number of tourists and local income • Better social and digital infrastructure • Active and productive cross-sector partnerships
Strengths		
• The rich history and culture of Islamic Mataram • Creative community and silver crafts • Unique local architecture and cuisine	• Developing cooperation with tourism operators (A1) • Developing history-based thematic tourism routes (A2)	• Organizing silver craft workshops for tourists (A5) • Organizing regular forums between government, organizations, and business actors (A6)
Aspirations		
• Becoming a national leading cultural destination • Educational and cultural preservation-based tourism experience • Community involvement as the main driver	• Developing tourism packages under complete community management. (A3) • Involving local communities in cultural preservation education and training (A4)	• Organizing regular cultural events such as festivals and art performances (A7) • Organizing monthly night markets or cultural bazaars (A8)

To gain a deep understanding and valid data on the direction of Kotagede Tourism Village development, especially in the Purbayan area, this study conducted a series of Focus Group Discussions

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
https://jutif.if.unsoed.ac.id
DOI: https://doi.org/10.52436/1.jutif.2025.6.4.4886

(FGDs) and in-depth interviews with various local stakeholders directly involved in cultural and tourism management. This approach aims to formulate elements in the SOAR (Strengths, Opportunities, Aspirations, Results) analysis framework, namely local strengths and uniqueness, external opportunities that can be utilized, collective hopes for the future, and real results expected in the short and medium term. This process involved eight strategic groups that are active at the community level, namely the Purbayan Village Community Empowerment Institution (LPMK) which understands social dynamics and community priorities; the Kotagede Cultural Heritage Area Conservation Agency (BPKCB) which oversees regulations for preserving historical sites; the PKK organization that focuses on strengthening the role of families and women; the Lawang Pethuk Community as the guardian of Kotagede's unique architectural values; the Puspok Foundation which develops the concept of a living museum based on residents' homes; Studio 76 which is engaged in the creative and performing arts sector; the Purbayan Tourism Village which runs village-based tourism operations; and the Purbayan UMKM Forkom which voices the economic interests of small business actors. The results of this activity were then synthesized into a map of strengths, opportunities, aspirations, and shared goals that formed the basis for compiling priority strategies. By being rooted in direct input from the community and local key actors, this process ensures that the strategies formulated are contextually relevant and reflect community ownership and commitment to sustainable cultural transformation. Table 1 shows the Alternatives used in this study.

2.3. BSC Analysis

To determine the strategy evaluation criteria, this study refers to the Balanced Scorecard (BSC) framework developed by Kaplan and Norton, which consists of four main perspectives: financial, customer, internal business process, and learning and growth. These four perspectives provide basic guidance in measuring strategy performance as a whole, not only in terms of finance but also user satisfaction, internal efficiency, and long-term development capacity. However, in the context of developing cultural tourism destinations, especially in cultural heritage areas such as Kotagede, adjustments are needed to meet the local community's unique characteristics and needs.

In this study, the four BSC perspectives were adjusted through participatory discussions in Focus Group Discussions (FGDs) and in-depth interviews, which also served as the basis for determining alternative strategies. Through this process, the BSC framework is applied normatively and contextualized by considering cultural values, community practices, and sustainability orientations that are developing in the Kotagede community. Thus, the criteria used in this study are conceptual and theoretical and reflect relevant local priorities in responding to the challenges of digitalization and cultural preservation. This study uses these four perspectives to compile sub-criteria and evaluate alternative strategies using the AHP approach. Table 2 shows the criteria and sub-criteria used in this study.

Table 2. Hierarchy of Criteria

Criteria	Sub-Criteria
Financial (C_1)	(C_{11}) Potential for increasing community income, (C_{11}) Efficient implementation costs.
Customer (C_2)	(C_{21}) Tourist comfort and satisfaction, (C_{22}) Immersive cultural experiences.
Internal Business Process (C_3)	(C_{31}) Efficient coordination across actors, (C_{32}) Readiness of digital or physical infrastructure
Learning and Growth (C_4)	(C_{41}) Community participation and empowerment, (C_{42}) Transfer of digital knowledge and training

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
https://jutif.if.unsoed.ac.id
DOI: https://doi.org/10.52436/1.jutif.2025.6.4.4886

2.4. Strategy Selection

This phase formulates and selects strategies to achieve organizational goals. The AHP method can prioritize and select strategies, considering subjective and uncertain factors. This phase will be discussed further in Chapter 3.

2.5. Evaluation

To ensure the robustness of strategic priorities, this study employs a sensitivity analysis by systematically adjusting the weighting of key evaluation criteria (derived from the Balanced Scorecard perspective) and examining how these changes impact the final strategy rankings. This process simulates various policy scenarios, such as an increased emphasis on financial outcomes or community learning, to assess the stability of the model's results. If the top-ranked strategies remain constant despite significant changes in criterion weighting, those priorities are considered resilient. Conversely, significant changes in rankings can indicate sensitivity to certain factors and inform future policy approaches. This analysis strengthens the credibility and practical applicability of the proposed decision-making framework in a dynamic planning environment. Comparative validation using another method, Simple Additive Weighting (SAW), will also be conducted to test the consistency of the rankings. This phase will be discussed further in Chapter 4.

3. RESULT

3.1. Decision Makers Selection and Data Collection Process

This study uses the Analytical Hierarchy Process (AHP) method to determine priority weights for the four main criteria of the Balanced Scorecard (BSC): Finance, Customer, Internal Business Process, and Learning and Growth. We value the input of all stakeholders, from community empowerment institutions to cultural heritage conservation agencies, in our systematic process, from consultation to validation.

This study uses two stages for weighting in the AHP method to ensure representative and unbiased decision-making. This study uses two stages for weighting in the AHP method to ensure representative and unbiased decision-making. Fourteen key stakeholders representing various perspectives carried out the assessment stage of weighting the main criteria and sub-criteria through FGD, namely: Community Empowerment Institution (LPMK) Purbayan (n = 2); Kotagede Cultural Heritage Area Conservation Agency (n = 1); Family Empowerment and Welfare (PKK) (n = 2); Lawang Pethuk Community (n = 3); Puspok Foundation (n = 1); Studio 76 (n = 1); Forkom UMKM Purbayan (n = 3); Village Head (n=1).

Next, to assess the comparative weight of decisions between alternatives and sub-criteria, the Head of Purbayan Village and the Head of BPKCB, who are key stakeholders, fill out a form to assess it. Their role is crucial in providing their expert opinions and insights.

3.2. Pairwise Comparison Matrix Construction

The main criteria comparison matrix was generated based on the collective agreement of the fourteen FGD group participants mentioned earlier. Table 3 shows a composite of the assessments of the fourteen decision-makers (Matrix A).

The pairwise comparison matrix reveals several key preferences among the four BSC perspectives. First, customer satisfaction is moderately more important than financial goals (value = 3.00), reflecting Kotagede's strategic focus on enhancing visitor experience before prioritizing direct economic outcomes. In addition, learning and growth—which encompasses capacity building and digital literacy—are more important than financial performance (value = 5.00). The high scores for

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
https://jutif.if.unsoed.ac.id
DOI: https://doi.org/10.52436/1.jutif.2025.6.4.4886

learning and growth underscore the long-term orientation of stakeholders who view sustainable development as rooted in human capital and knowledge.

Learning and growth initiatives are still moderately more important than customer-oriented programs (value = 3.00), highlighting the belief that internal readiness must precede effective external delivery. Interestingly, internal process efficiency is regarded as equally important to financial outcomes (value = 1.00), indicating a recognition that well-functioning systems are fundamental for driving performance. Finally, decision-makers prioritize learning and growth, considering it much more important than internal processes (score = 5.00), indicating that they prefer transformational change over incremental operational improvements.

Table 3. The Pairwise Comparison Matrix

	Financial	**Customer**	**Internal Process**	**Learning and Growth**
Financial	1.00	0.33	1.00	0.20
Customer	3.00	1.00	3.00	0.33
Internal Process	1.00	0.33	1.00	0.20
Learning and Growth	5.00	3.00	5.00	1.00

3.3. Weight Calculation and Consistency Validation

1. Step 1: Matrix Normalization

Each element in the matrix A (table 3) is normalized by dividing the elements in the column by the total number of elements in that column using the following formula:

$$A_{ij}^{\text{norm}} = \frac{A_{ij}}{\sum_i A_{ij}} \quad (1)$$

2. Step 2: Priority Weight Calculation

The following criteria weight is calculated by taking the average value of each row of the normalized matrix using the formula:

$$w_i^{main} = \frac{1}{n}\sum_j A_{ij}^{\text{norm}} \quad (2)$$

3. Step 3: Consistency Validation

Logical consistency between assessments is tested using the following steps:

- Compute the weighted sum vector $w \rightarrow A \cdot w$
- Estimate the maximum eigenvalue:

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n} \frac{(A \cdot w)_i}{w_i} \quad (3)$$

- Calculate the consistency index (CI):

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (4)$$

- Determine the consistency ratio (CR):

$$CR = \frac{CI}{RI} \quad (5)$$

where and The Random Index (RI) value of 0.90 for a 4 × 4 matrix is taken from Saaty's original simulation results as shown in [18]. If CR < 0.1, then the results are declared consistent. The final results

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
https://jutif.if.unsoed.ac.id
DOI: https://doi.org/10.52436/1.jutif.2025.6.4.4886

show that the weight calculation meets the consistency criteria, with a CR value = 0.0161 < 0.1. Table 4 shows the weights of the main criteria.

Table 4. Main Criteria Weights

Criteria	Weights
Learning and Growth	0.5549
Customer	0.2516
Financial	0.0967
Internal Business Process	0.0967

3.4. Sub-criteria Weight Determination

After obtaining the weight of each main criterion of the Balanced Scorecard (BSC), the next stage in the Analytical Hierarchy Process (AHP) method is to determine the weight of the sub-criteria that are direct derivatives of each main criterion. Each BSC perspective contains its own set of sub-criteria, which are evaluated through similar pairwise comparisons. For example, under the Customer perspective:

$$ACustomer = \begin{bmatrix} 1 & \frac{1}{3} \\ 3 & 1 \end{bmatrix}$$

This matrix reflects expert agreement that *Cultural Experience* is moderately more important than *Tourist Comfort,* aligning with Kotagede's positioning as a heritage destination where authenticity matters more than amenities. Next, the subcriteria's normalization process and local weighting are carried out. Each 2×2 matrix is normalized using the formula:

$$a_{ij}^{\text{norm}} = \frac{a_{ij}}{\sum_i a_{ij}} \quad (6)$$

then the local weight is calculated by:

$$w_i^{local} = \frac{1}{n}\sum_i a_{ij}^{\text{norm}} \quad (7)$$

Next, the global weight of the sub-criteria is calculated. The global weight of the sub-criteria is calculated by multiplying the local weight by the global weight of the main criteria:

$$W_{ij} = w_{ij}^{local} \times w_i^{main} \quad (8)$$

Calculation Example:

If the weight of the Customer criterion is 0.25, and the local weight of the sub-criteria:

- Tourist comfort and satisfaction: 0.25
- Immersive cultural experiences: 0.75

then:

$W_{satisfaction}$ = 0.25 × 0.2516 = 0.0629

$W_{experiences}$= 0.75 × 0.2516 = 0.1887

Table 5 shows the global weights of all sub-criteria used.

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
https://jutif.if.unsoed.ac.id
DOI: https://doi.org/10.52436/1.jutif.2025.6.4.4886

Table 5. Sub-Criteria Weights

Criteria	Sub-Criteria	Local Weights	Global Weights
Financial	Potential for increasing community income.	0.75	0.725
Financial	Efficient implementation costs.	0.25	0.0242
Customer	Tourist comfort and satisfaction.	0.25	0.0629
Customer	Immersive cultural experiences.	0.75	0.1887
Internal Business Process	Efficient coordination across actors.	0.75	0.0725
Internal Business Process	Readiness of digital or physical infrastructure.	0.25	0.0242
Learning and Growth	Community participation and empowerment.	0.25	0.1387
Learning and Growth	Transfer of digital knowledge and training	0.75	0.4162

3.5. Alternative Strategy Evaluation

After obtaining the global weights of each sub-criterion, the next step in the AHP method is to evaluate each alternative strategy against each sub-criterion. This process involves creating a pairwise comparison matrix between the eight alternatives against each sub-criterion using the Saaty scale. The comparison matrix between subcriteria and alternatives is determined based on the assessment of two decision-makers: the Village Head and the Head of BPKCB. Two decision-makers were used because the Village Head and the Head of BPKCB are the main decision-makers who can determine the development strategy for Kotagede tourist destinations. The Geometric Mean method is used to aggregate the values of the two decision-makers. as follows:

$$a_{ij}^{\text{agregat}} = \left(\prod_{k=1}^{m} a_{ij}^{(k)}\right)^{\frac{1}{m}} \quad (9)$$

where:

- $a_{ij}^{(k)}$ denote the pairwise comparison value given by the k^{th} decision-maker between element i and element j,
- m represent the total number of decision-makers,
- $a_{ij}^{\text{aggregate}}$ represent the aggregated (combined) comparison value between element element i and element j.

The geometric mean was chosen because Saaty, the developer of the AHP method, explicitly recommended it for group decision-making aggregation due to its ability to maintain mathematical consistency and interpretability of the results [19]. Each matrix produces a local weight for the alternative against a particular sub-criterion. These weights are then multiplied by the global weights of the sub-criterion to produce a score for the alternative's contribution to the main objective.

3.6. Final Strategy Ranking

Mathematically, the final score of an alternative A_k against the entire AHP structure can be calculated using the following formula:

$$S_k = \sum(w_{ij} \times a_{kj}) \quad (10)$$

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
https://jutif.if.unsoed.ac.id
DOI: https://doi.org/10.52436/1.jutif.2025.6.4.4886

where:

- S_k = Total score of the k alternative
- w_{ij} = Global weight of the j sub-criterion
- a_{kj} = Local weight of the k alternative with respect to the j sub-criterion

This process is repeated for all sub-criteria. The final score of each alternative is obtained from the sum of contributions to all sub-criteria, resulting in a final ranking that reflects the priority of strategy implementation in supporting the Kotagede 2030 vision. Table 6 shows the final ranking results of the eight alternative strategies based on the total AHP score.

Table 6. Final Weights and ranking of alternatives.

Alternatives	SC1.1	SC1.2	SC2.1	SC2.2	SC3.1	SC3.2	SC4.1	SC4.2	Weight	Rank
A1	2,435	0,016	1,317	0,013	0,370	1,304	2,982	0,088	0,771	1
A2	0,809	0,022	1,111	0,033	0,146	0,927	1,370	0,119	0,408	3
A3	1,289	0,025	0,534	0,094	0,310	0,326	0,852	0,141	0,353	4
A4	1,684	0,023	0,283	0,146	0,234	0,276	2,122	0,257	0,593	2
A5	0,219	0,101	0,120	0,082	0,056	0,116	0,280	0,022	0,096	8
A6	0,191	0,072	0,288	0,014	0,647	0,597	0,286	0,141	0,196	5
A7	0,351	0,073	0,769	0,050	0,146	0,651	0,276	0,051	0,171	7
A8	0,488	0,070	0,668	0,050	0,146	0,590	0,280	0,051	0,174	6

SC = Sub-Criteria Weight

The results of this study offer clear and practical recommendations that can be directly applied to Kotagede's strategic development. By identifying the "Developing cooperation with tourism operators (A_1)" and "Involving local communities in cultural preservation education and training (A_4)" as priority strategies, these findings underscore the importance of developing inclusive networks and empowering local stakeholders with digital skills. This perspective is particularly relevant to the Kotagede context, where substantial cultural capital and community cohesion exist, but these have not been fully leveraged through digital platforms.

In practice, local governments, heritage institutions, and community tourism groups in Kotagede can adopt this classification of strategies to guide program design and resource allocation. For example, prioritizing digital literacy workshops for MSMEs, developing partnerships with online cultural marketplaces, and enhancing interpretive storytelling through digital media align with the priority strategies. Furthermore, the use of a transparent and participatory framework ensures that strategies not only reflect local aspirations but also maintain stakeholder engagement throughout the implementation process.

Compared to previous studies, such as the exclusive use of the BSC to assess MSME performance in Pantai Lombang [16] or the emphasis on local wisdom in Banyumas without prioritizing digital resources [15], this study presents a more integrated and systematic model. While these studies focused on performance measurement or conceptual planning, this study's hybrid SOAR-BSC-AHP framework allows for the determination of measurable, community-aligned strategic priorities. This framework balances a qualitative stakeholder perspective with rigorous multi-criteria analysis, offering unique advantages in contexts requiring cultural sensitivity and accountability in planning.

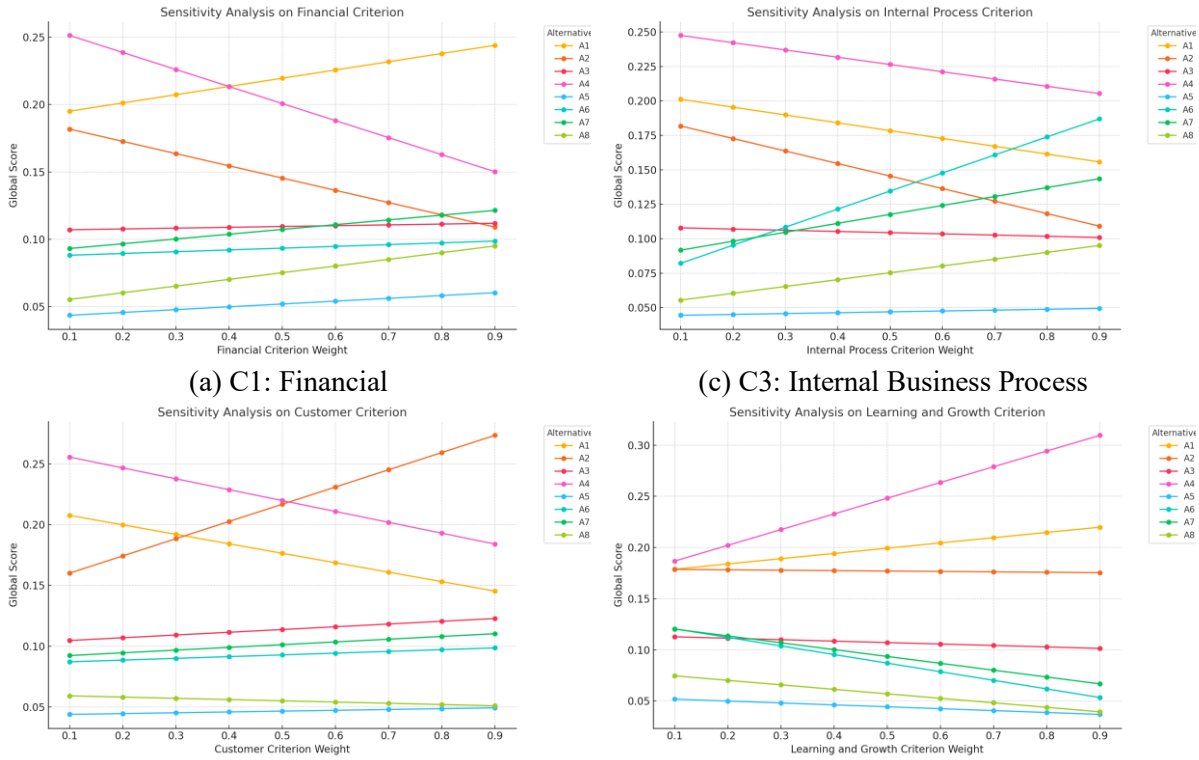
4. DISCUSSIONS

This research conducts a sensitivity analysis using the one-at-a-time approach to test the robustness of the strategy ranking results against potential changes in stakeholder perceptions of each criterion's importance. In this analysis, the weight of one primary criterion of the Balanced Scorecard—Financial, Customer, Internal Business Process, and Learning and Growth—was changed incrementally

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
https://jutif.if.unsoed.ac.id
DOI: https://doi.org/10.52436/1.jutif.2025.6.4.4886

from 0.1 to 0.9. In contrast, the weights of the other three criteria were adjusted proportionally to their initial significance. This approach aimed to see whether the strategy rankings would change substantially if the policy focus shifted from one dimension to another.

The sensitivity analysis depicted in Figure 2(a) maps the interaction between strategy effectiveness and financial criteria weights. As the weight of the Financial criterion increases, A1 and A3 show the sharpest increases in scores, indicating that these strategies have the potential to significantly increase revenue and efficiency. In contrast, A4 and A2 experience a decrease in scores, reflecting that their orientation is more on social or cultural values than on financial aspects.



(a) C1: Financial

(c) C3: Internal Business Process

(b) C2: Customer

(d) C4: Learning and Growth

Figure 2. Sensitivity analysis for criteria weights.

Figure 2(b) shows the sensitivity of the strategy to changes in customer criterion (C2). Increasing the weight of the Customer criterion significantly impacts strategy A2, whose global score increases as the focus on visitor experience increases. A1 remains stable, while A4 decreases slightly, indicating that community education-based strategies emphasize tourist convenience or satisfaction less. Strategies A6 and A7 also show slight increases, indicating a moderate relationship with visitor preferences.

Figure 2(c) illustrates the strategic response to variations in internal process criterion (C3). Strategies A6 and A7 increase in scores as the weight of the Internal Process criterion increases, indicating a dependence on the quality of coordination and operational infrastructure. A1 and A2 remain competitive, indicating stability across contexts. In contrast, A5 and A8 remain low, indicating a low contribution to internal process efficiency.

Figure 2(d) illustrates how different strategies react to the learning and growth criterion (C4). As the Learning and Growth weight increases, strategy A4 shows a significant increase in score, reflecting high alignment with the learning and community empowerment aspects. Strategies A1 and A2 tend to be stable and remain superior, indicating high resilience although not the most sensitive to this criterion. In contrast, the analysis shows that A5 and A8 consistently receive low scores across the weight variations, indicating a limited contribution to the learning aspect.

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
https://jutif.if.unsoed.ac.id
DOI: https://doi.org/10.52436/1.jutif.2025.6.4.4886

Strategy A1 (Developing cooperation with tourism operators) is the most resilient strategy because its score is consistently high across all scenarios. This strategy excels in the AHP baseline and is less sensitive to fluctuations in policy focus, making it a safe and flexible priority choice.

Strategy A4 (Involving local communities in cultural preservation education and training) is very strong when the development focus is on Learning and Growth but unstable if the orientation shifts to financial or operational aspects. In contrast, A2 (Developing history-based thematic tourism routes) will be very effective if the development strategy emphasizes more Customer Experience. Decision-makers can use these results as a dynamic reference to adjust strategic choices based on the orientation of Kotagede's cultural tourism development policies in the short and long term.

Furthermore, to support the validity of the strategy ranking results in developing Kotagede as a sustainable cultural tourism destination, testing was carried out using the Simple Additive Weighting (SAW) method on the results obtained from the Analytical Hierarchy Process (AHP) method. The primary purpose of using SAW in this context is to test whether the strategy rankings obtained through AHP are stable or show sensitivity to different evaluation approaches. Researchers have also carried out testing using other methods, especially SAW [20].

Table 7 shows that the strategy rankings obtained through SAW are consistent with the AHP results. The top three strategies (A1, A4, and A2) remain at the top in both methods, although there is a slight order exchange between A1 and A4. This indicates that these strategies have high-performance consistency, both in terms of the hierarchical and aggregate approaches. Meanwhile, the lower-ranked strategies, such as A5, A7, and A8, also show similar position stability in both approaches, confirming that the performance of these strategies is relatively weaker against the established criteria and sub-criteria.

Table 7. Comparison of AHP and SAW Results

Alternatives	AHP Weight	AHP Ranking	SAW Weight	SAW Ranking
Developing cooperation with tourism operators (A1)	0.771	1	0,43	2
Involving local communities in cultural preservation education and training (A4)	0.593	2	0,55	1
Developing history-based thematic tourism routes (A2)	0.408	3	0,37	3
Developing tourism packages under complete community management. (A3)	0.353	4	0,19	4
Organizing regular forums between government, organizations, and business actors (A6)	0.196	5	0,24	6
Organizing monthly night markets or cultural bazaars (A8)	0.174	6	0,17	7
Organizing regular cultural events such as festivals and art performances (A7)	0.171	7	0,18	5
Organizing silver craft workshops for tourists (A5)	0.096	8	0,15	8

The findings of this study have important practical implications for the governance of Kotagede's cultural tourism. Priority strategies, such as “Developing cooperation with tourism operators (A1)” and “Involving local communities in cultural preservation education and training (A4)”, highlight the urgent need for a knowledge- and collaborative-based development model. Local government agencies and cultural heritage institutions can use these results as a strategic roadmap to align program interventions with measurable community outcomes. For example, the high priority given to Learning and Growth

Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
https://jutif.if.unsoed.ac.id
DOI: https://doi.org/10.52436/1.jutif.2025.6.4.4886

suggests that investments in digital literacy, content creation training, and community storytelling can directly enhance Kotagede's competitiveness as a heritage destination. Programs that integrate local artists and youth groups into digital promotion initiatives, such as virtual museum tours or e-commerce for cultural products, can generate social and economic benefits.

Furthermore, the sensitivity analysis offers flexible guidance for policymaking. Decision-makers can adapt their strategies in response to changing policy objectives, whether focusing on economic recovery, visitor satisfaction, internal efficiency, or long-term human resource development. This flexibility is crucial in the post-pandemic recovery phase, where tourism demand can change rapidly and digital resilience is a key factor.

5. CONCLUSION

This study presents a hybrid strategic framework that integrates SOAR analysis, BSC, and the AHP to guide the digital transformation of community-based cultural tourism in Kotagede. By combining participatory qualitative input with structured quantitative prioritization, the study successfully identified and ranked eight strategic alternatives. Among them, developing partnerships with tour operators and community-based cultural education and training emerged as top priorities. The Learning and Growth perspective received the highest weighting, emphasizing the importance of digital literacy and community empowerment in driving sustainable tourism development. Theoretically, this research contributes to bridging the gap between aspirational planning and data-driven decision-making within heritage tourism contexts—an area previously dominated by fragmented approaches. These findings demonstrate how the integration of multiple frameworks can connect community aspirations with data-driven decision-making in the context of cultural heritage tourism, an area that fragmented planning models have previously neglected. Methodologically, the study validates the consistency and robustness of the strategy rankings through sensitivity analysis and comparative testing using the SAW method, reinforcing the reliability of the proposed approach. Despite these contributions, the study has limitations. The model is based on expert opinions from a relatively small sample of key stakeholders in Kotagede, which may limit its generalizability. Furthermore, its field implementation may face operational and sociopolitical challenges, such as resource constraints, institutional coordination, or resistance to change. More extensive data collection and a long-term pilot implementation are needed to assess the practical feasibility of this framework further. It is recommended that future research explore the integration of other decision-support methods, such as Fuzzy AHP or DEMATEL, to increase sensitivity to uncertainty and stakeholder dynamics. Applying this framework to other cultural tourism destinations, particularly those with different socioeconomic and technological conditions, provides valuable comparative information and further validates the model's adaptability.

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Vol. 6, No. 4, Agustus 2025, Page. 2053-2066
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