Sustainability Assessment of Tourism Destination with Multidimensional Scaling Approaches

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Abstract

Flower Garden Celosia in Semarang, Central Java, is a man-made tourism destination that offers a landscape of a beautiful flower garden and miniature of world icons for visitors to take a photograph. The flower garden management still focuses on business development and the practice of sustainable tourism not implemented properly. A sustainability assessment is required to evaluate the impact of business growth to the environment and social impact to destination and local community. Assessment of sustainability status conduct used Rap-Tourism method, a modification of Rap-fish (Rapid Appraisal for Fisheries) method with Multidimensional Scaling (MDS) analysis technique. This sustainability assessment has four dimensions: environment, economy, socio-cultural and institutional. The results of the MDS analysis show that the sustainability status of Flower Garden is sustainable with an index of 63.52. The index for each dimension is environmental dimensions of 55.34 (sustainable), the economic dimension of 100.00 (very sustainable), the socio-cultural dimension of 71.04 (sustainable), and the institutional dimension of 63.14 (sustainable). The lowest index value is the environmental dimension and the most sensitive attribute to sustainability status is the environmental management and protection system so that the recommendation is the preparation of Environmental Management Efforts and Environmental Monitoring Efforts, Evaluation of Plant Maintenance Performance, waste sorting, and evaluation of environmental management.

Keywords
Tourism, Sustainability Status, Rap-tourism, MDS

1. Introduction
The tourism industry contributes to the Indonesia National GDP of 4.03% and creates a foreign exchange between IDR 176 to 184 trillion annually. The tourism industry also contributes to the employment of 12 million people. The development of tourism destinations must be done in an integrated, sustainable, and responsible manner. The development of tourism to provide long-term benefits must implement the concept of sustainable tourism. Sustainable tourism is defined as tourism that takes current and future economic, social, and environmental impacts into account, as well as meeting the needs of visitors, industry, the environment, and the local community (Ministry of Tourism 2016).

A sustainability assessment is required to track the growth of a tourist destination. This assessment's findings will also indicate which aspects of tourism need to be improved. The research on sustainable tourism is divided into two major groups, the first of which aims to develop assessment indicators using literature reviews and expert opinions, and the second of which aims to develop assessment indicators. Research on the development of tourism sustainability assessment indicators was done by (Blancas et al. 2016, Agyeiwaah et al. 2017, Asmelash and Kumar 2019, Vukadin et al. 2020). Meanwhile, research on the assessment of the sustainability status of tourist destinations is (Kozic and Mikulic 2011, Hussain et al. 2015, Bhuiyan et al. 2015, Blancas et al. 2015, Huang and Coelho 2017, Ziaabadi et al. 2017, Delgado and Palomeque 2018, Oyola et al. 2019, Weng et al. 2019, Asadpourian et al. 2020).

In measuring the sustainability of an object that involves many indicators an aggregation method is needed to produce an index value. The method that is widely used is the composite indicators and multi-dimensional scaling (MDS) and

composite indicator. The use of MDS is relatively new as an outgrowth of the rap-fish method (Pitcher and Preikshot 2001) transformed into a rap-tourism (Dwikorawati 2012, Purwaningsih et al. 2020, Purwaningsih, Santoso, and Khasanah 2020). Rap-tourism analyzes data using Multidimensional scaling (MDS), which is widely used to determine the sustainability status of natural resource management, such as in analyzing the sustainability of tourism in the Puncak Bogor Area (Dwikorawati 2012), analyzing the sustainability of Mangrove Protection Forest in Batu Ampar (Karlina et al. 2016), and analyzing the sustainability of contract farming broiler chickens (Susanty 2020).

The purpose of this study is to assess the sustainability of a tourism destination, a flower garden located on the mountain slopes of Central Java, Indonesia. The destination provides photo spots for visitors in the form of flower gardens, miniature landmarks of various countries, an illusory selfie museum, a children's playground, and souvenir shopping. The garden was officially opened in 2017, currently, the management is still concentrating on business development and does not yet have a plan based on sustainable tourism destination management. The sustainability status of the garden was measure in four dimensions, environmental, economic, socio-cultural, and institutional. The values of each assessment attribute indicated the weak point of the dimension which needs more attention from management and stakeholders in focusing effort to develop a program to increase its sustainability.

2. Research Methods

The assessment of the sustainability of tourism is carried out through several stages.

1. The first step is to review the elements and attributes of each dimension of sustainability. Evaluation and determination of attributes are done by studying the literature and testing the assessment model with expert opinion.
2. The second stage is to provide an assessment by scoring on a scale of 0-3 based on the results of field observations according to the specified classification. The level and scale arrangement are sequential from lowest to highest.
3. The third step is data collecting, primary data were obtained by deep interviews and questionnaires filled by managers of tourist destinations, local governments, village officials, and communities around the tourist sites.
4. The fourth step is to calculate the value of the sustainability index by evaluating the attributes of each dimension of sustainability which are then categorized into four criteria: good, good enough, not good, and bad. The performance of the management of tourist destinations has a range of values between 0 to 100.
5. The fifth step is the leverage factor analysis. Leverage analysis is a method of determining the sensitive attributes that contribute to improving the sustainability status of tourism destinations by illustrating the sensitivity of each attribute to the value of sustainability.
6. The sixth stage is the Conformity Test (goodness of fit) to determine whether the attributes examined in the MDS analysis are accurate enough and scientifically justified based on the stress value and the coefficient of determination (R2).

The sustainability status of a tourism destination defines in step fourth use the sustainability index range value shown in Table 1.

Table 1. Sustainability Category Status

No.	Sustainability Index	Status
1	0.00-25.00	Unsustainable
2	25.01-50.00	Less Sustainable
3	50.01-75.00	Sustainable
4	75.01-100.00	Good or very sustainable

Leverage factors define sensitive attributes based on priority order. Leverage analysis by looking at the change in root mean square (RMS) ordination on the X-axis or the sustainability scale. The greater the value of RMS changes, the greater the role of these attributes in increasing the status of sustainability. The conformity test result is a stress value, represent the reliability test. If the value is smaller than 0.25 or 25%, then the result was concluded as reliable. While the value of coefficient determination represents the Validity Test and is considered valid if the value is close to 1 or 100% (Kavanagh and Picther 2004).

The sustainability index value is defined using a composite index based on the index value of each dimension. The composite index value is calculated by first weighting each dimension and then multiplying the index value of each

dimension by the index value of each dimension. The normalization ranking of each dimension yields the weight value. The tourism site manager is in charge of ranking each dimension. The formulas are given on Equations 1, 2, and 3.

$$w_j = \frac{(1/r_j)}{\sum(1/r_k)} \qquad (1)$$
$$iw_j = w_j \; x \; i_j \qquad (2)$$
$$ii_k = \sum(iw_j) \qquad (3)$$

Where; w for weight; r for *ranking*; j for dimension; k for dimension; i for the value of sustainability index.

A recommendation for improvement is derived from the opinions of relevant experts and literature studies based on the results of data processing and analysis. Alternative recommendations are rated by using a minus and plus sign, shown in Table 2. The criteria for selecting the recommendation are the feasibility of implementation (period and cost) and the significant impact of the program in increasing sustainability.

Table 2. Criteria for Assessment of recommendation

Feasibility of implementation	Duration of Implementation	Value	Meaning
Difficult	Short	-	Bad
Difficult	Long	=	Same
Easy	Short	+	Better
Easy	Long	++	Much Better
Difficult	Short	-	Bad

3. Results and Discussion

The research was carried out from April to June of 2020. The data processing result displays the sustainability index value, the Root Mean Square (RMS), the stress value, and the coefficient of determination (R2). Table 3 displays the RMS values for all attributes in each dimension. Table 4 shows the Stress Values and Determination Coefficients. The study was conducted from April until June 2018. The result of data processing shows the index value of sustainability, the Root Mean Square (RMS), the stress value, and the coefficient of determination (R2). The RMS values for all attributes in each dimension can be seen in Table 3. The Stress Values and Determination Coefficients in Table 4.

Table 3. RMS value attribute

Dimension	Code	Attribute	RMS
Environment	L1	Management and environmental protection system	0,47*
	L2	Flora inventory	0,18
	L3	Prohibition of acts of destruction of flora	0,38
	L4	Energy consumption reporting	0,42
	L5	Safety and water quality management system	0,26
	L6	Waste treatment program	0,47
Economic	E1	Periodic financial statements	0,01
	E2	Employment for local people	0
	E3	Support local businesses	0,06*
	E4	Communication to accommodate the aspirations of local people	0
	E5	Communication on tourism issues	0
Socio-cultural	S1	Cultural and tourist guides	6,09
	S2	Visitor management system	4,49
	S3	Information is available in a variety of media formats.	17,46*
	S4	Relations with the local community	4,51

Dimension	Code	Attribute	RMS
Institutional	K1	Responsible and coordinated organization	0,81
	K2	Participation of the community, government, private sector, and entrepreneurs as stakeholders	0,73
	K3	Sustainable tourism destination development strategy	2,45
	K4	Tourism destination management system	0,82
	K5	Tourism marketing strategy	3,80*
	K6	Seasonal change mitigation policies	3,35
	K7	Emergency handling and response system to safety and security	0,91
	K8	Hazard detection and prevention systems	0,83
	K9	Regular asset inventory	2,98
	K10	Accessibility that promotes tourist accommodations for people with disabilities and special needs	0,7
	K11	Management is concerned about visitor satisfaction.	1,81
	K12	The level of visitor satisfaction	1,03

(*) = sensitive attribute

Table 4. Stress Values and Determination Coefficients

Dimension	Sustainability Index	Suitability Test			Sustainability Status
		Stress	R²	Iteration	
Environment	55,34	0,17	0,94	2	Simply sustainable
Economic	100,00	0,14	0,94	2	Very sustainable
Socio-Cultural	62,21	0,16	0,92	3	Simply sustainable
Institutional	63,14	0,14	0,95	2	Simply sustainable

3.1 The Environmental Dimension's Sustainability Index

MDS results on the environmental dimension have a sustainability index value of 55.34, categorized as quite sustainable. Leverage factor analysis on the environmental dimension obtained the sensitive attributes is the environmental management and protection system and the waste treatment program, both have RMS value of 0.47. Index and leverage values can be seen in Figures 1 and 2.
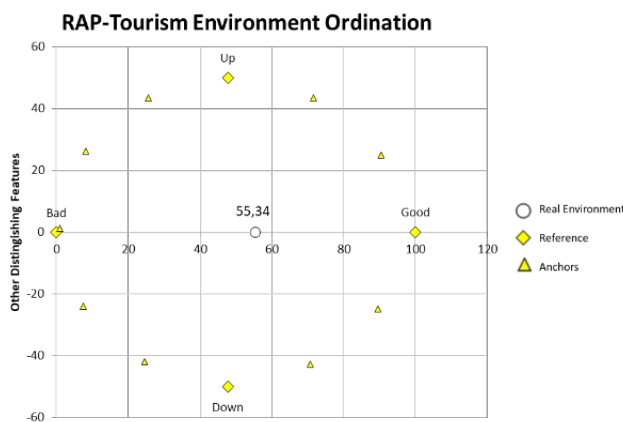

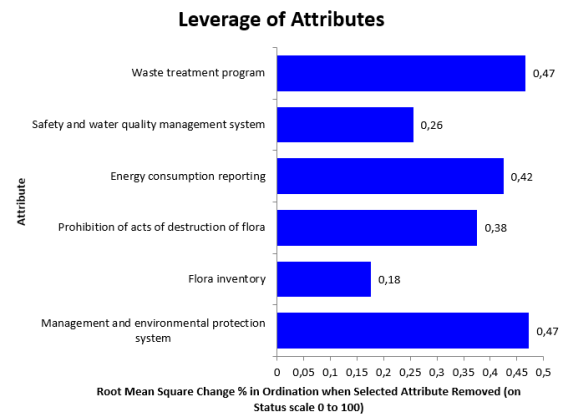Figure 1. Environmental Sustainability Index.

Figure 2. Leverage Environmental Attributes.

3.2 The Economic Dimension's Sustainability Index

MDS results on the economic dimension have a sustainability index value of 100.00, indicating that it is classified as highly sustainable. Leverage factor analysis was performed on five economic dimension attributes, yielding the attribute with the highest or most sensitive RMS value, which is supporting local businesses, with an RMS value of 0.06. The values of the index and leverage can be found in Figures 3 and 4.
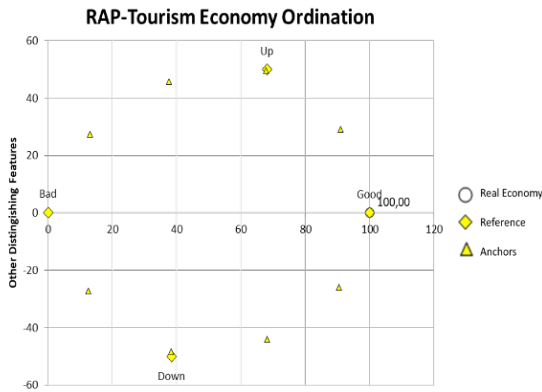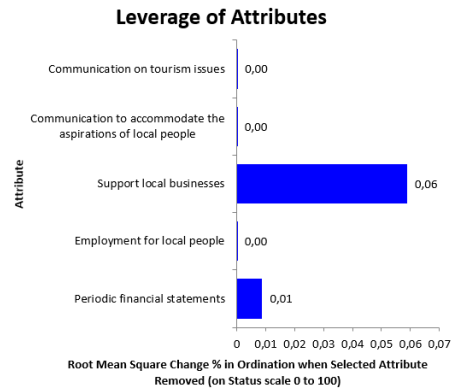

Figure 3. Economic Sustainability Index

Figure 4. Leverage Economic Attributes.

3.3 The Socio-Cultural Dimension Sustainability Index

MDS results on the economic dimension have a sustainability index value of 62.21 which means it is included in the quite sustainable category. Leverage factor analysis is performed on 4 attributes on the socio-cultural dimension. Based on the value of RMS obtained the most sensitive attribute is the Information is available in a variety of media formats with an RMS value of 17.46. Index and leverage values can be seen in Figures 5 and 6.
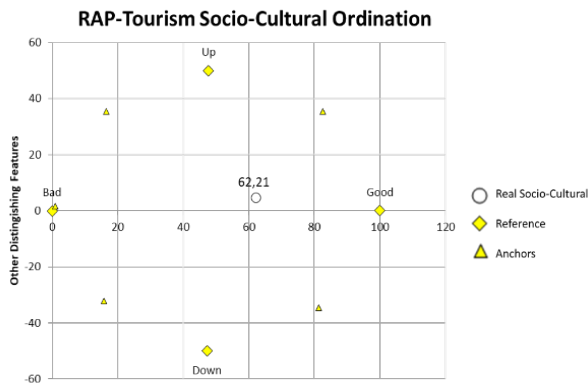

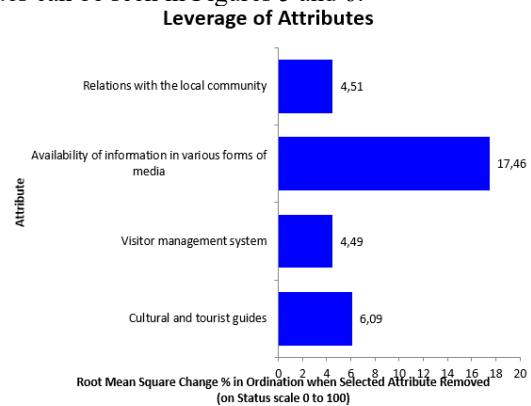Figure 5. Socio-Cultural Sustainability Index

Figure 6. Leverage Socio-Cultural Attribute

3.4 The Institutional Dimension's Sustainability Index

MDS results on the economic dimension have a sustainability index value of 63.14 which means it is included in the quite sustainable category. Leverage factor analysis is performed on 12 attributes on the institutional dimension. Based on the RMS value, the most sensitive attribute is tourism promotion strategy with an RMS value of 3.80. Index and leverage values can be seen in Figures 7 and 8.
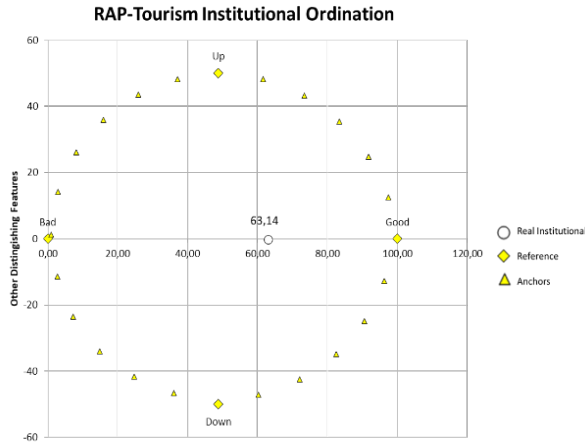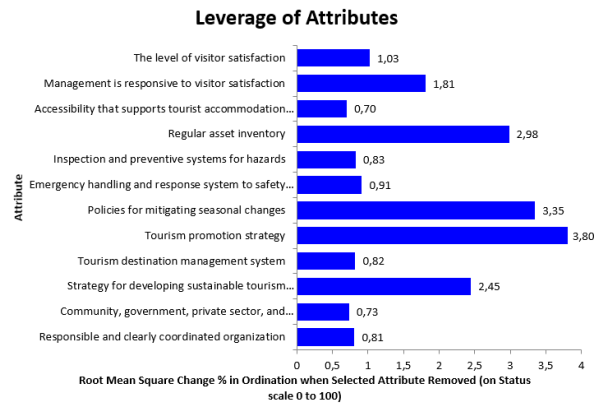
Figure 7. Institutional Sustainability Index

Figure 8. Leverage Institutional Attributes.

3.5 Sustainability Status

The flower garden's sustainability status is moderately sustainable, as indicated by a sustainability index value of 63.52. The weighting of the ranking method, which is determined by the technical manager of the tourism object manager, give significant influence to the value of sustainability status. The sustainability index for each dimension, the weight of importance, and the index of sustainability shown in Table 5. Figure 9 depicts a kite diagram depicting the sustainability index for each dimension. As a differentiator, sensitive attributes on each dimension are marked with an asterisk.

Table 5. Stress Values and Determination Coefficients

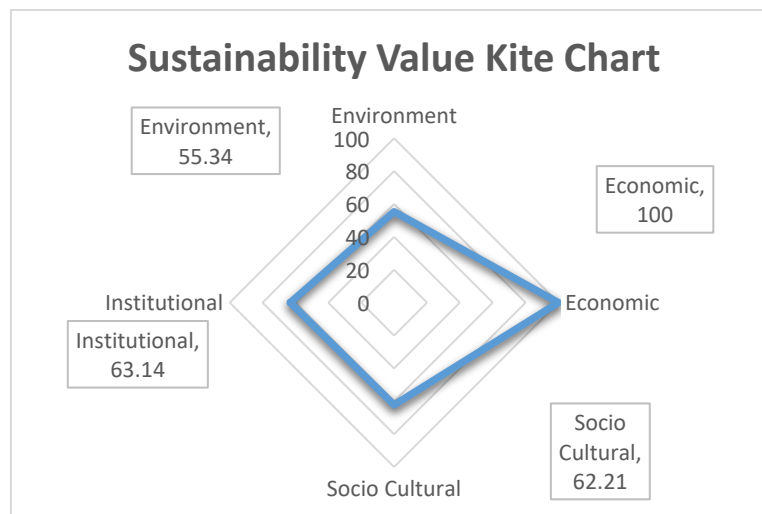| Dimension	Sustainability Index	Rank	Weight	Weighting Results
Environment	55,34	1	0,4	22,14
Economic	100	4	0,1	10,00
Socio-Cultural	62,21	3	0,2	12,44
Institutional	63,14	2	0,3	18,94
Value				63,52

Figure 9. Sustainability Value Kite Chart

3.5 Recommendations for Improvement

According to the data processing results, Taman Bunga X's sustainability status is quite sustainable, with a sustainability index value of 63.52. The lowest index value in the environmental dimension is 55.34, with the highest or most sensitive attribute value being the environmental management and protection system with an RMS value of 0.47. The selected attributes that need recommendations for improvement is the management system and environmental protection. The environmental management and protection system is a systematic and integrated effort to preserve environmental functions and prevent pollution and damage to the environment. Formulation of recommendation should consider the feasibility and the impact to the sustainability increase, feasibility consider how difficult the program to be applied according to cost and time consume (Purwaningsih, 2018)

The development of a tourist destination requires cooperation between the various parties involved. There are six stakeholders in management of tourism sustainability, tourist or visitors, local community, tour management agency, Government, Tourism supporting facilities, Tourism destination management (Purwaningsih, 2020). The prepared recommendations for improvement were obtained from a variety of sources, including the Regional Regulation and previous research, as well as the opinion of the Head of Environmental Damage Control Division of the Semarang Regency Environmental Agency. Recommendations for improvement are Compilation of Environmental Management Efforts and Environmental Monitoring Efforts, Evaluation of Plant Maintenance Performance, Waste Sorting, and Environmental Management Evaluation.

4. Conclusion

The results of the assessment of sustainability on Celosia Flower Garden is quite sustainable. The environmental, socio-cultural, and institutional dimensions are still quite sustainable while the economic dimension is very sustainable. Rap tourism provides a sustainability index and leverage factor to determine attributes on each dimension that need to be improved because they have a significant effect on increasing sustainability.

The environment dimension has the lowest value compares to other dimensions. The attributes of the environmental dimension which need more attention are environmental management and protection system. Recommendations for improvement are Compilation of Environmental Management Efforts and Environmental Monitoring Efforts, Evaluation of Plant Maintenance Performance, Waste Sorting, Environmental Management Evaluation.

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