

**The Site Suitability Evaluation of
Potential Urban Park:
A Case Study of Surabaya, Indonesia**

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Hepi Hapsari HANDAYANI

Abstract

Urban expansion has increased rapidly in size and density, and green space as a protector of the environment has come under more pressure during the urbanization process. Comprehensive studies have confirmed the importance of publicly accessible green space, such as urban park, and its ability to provide benefits to the general public. Urban park is a vital environmental component of urban land use to supply leisure and recreational activity for neighbourhood and to offer a spot for social interaction that preserves neighborhood connections. To develop urban park, a sustainable concept should be adopted. Sustainable development is characterized as “dynamic process” deriving from a planned design and striking a “balance” among environmental, social, and economic values. Consequently, a sustainable plan should predict and shape the extent of future development, recognize current and emerging requirement, and ensure that the residents’ needs have been met. Herein, the sustainable development of urban park should facilitate the social life of the neighborhood to promote their satisfaction.

Surabaya in Indonesia has experienced economic growth and increases in population, especially in the central Surabaya where Central Business District (CBD) was established. However, in this central area, the amount of urban park per capita is low, approximately on 0.301 m². Thus, the sustainable development of urban park is crucial in providing local residents with a satisfactory standard of living. Bareland and grassland can be proposed as potential site of urban park. Therefore, the purpose of this study is to investigate and evaluate the site suitability of sustainable development of potential urban park in central Surabaya. The specific objectives are as follows: (1) to investigate the site suitability of potential urban park using the Analytic Hierarchy Process (AHP) approach; (2) to evaluate the site suitability of potential urban park; (3) to propose a Potential Satisfaction of Urban Park Index (PSPI) in order to assess the neighbourhood satisfaction objectively; and (4) to conduct a case analysis based on the

combination of site suitability with different level to select the most recommended plan concerning sustainable perspective.

For the AHP analysis, two concepts including site and neighbourhood characteristics were applied. A total of four sub-criteria and 12 factors were included in the AHP model, with their relative weight determined by experts and specialists from various backgrounds. The AHP analysis indicated that the land ownership factor was ranked highest, followed by walking distance, and then safety of the environment. To check the consistency of the factor ranking, Kendall's coefficient of concordance was applied, using a 95% confidence interval. The coefficient had a moderate level of 0.737, indicating consistency of ranking between the experts.

The Suitability Index (SI) of potential urban park had the lowest value of 0.3 and the highest value of 0.779. Four potential sites had an SI greater than 0.677, indicating very high suitability, these were located mainly in the north area as part of Gading village. Low and intermediate levels of suitability applied to the same number of potential sites (22 each), which were found mostly to the west. However, a large number of 20 potential sites assigned for very low suitability which were identified in the east and west part and three of them were located in the CBD area. The evaluation of site suitability revealed that portion of the government asset and land value affected the assessment. The accessibility and the safety environment came next in importance. Thus, the high proximity and volume of potential user should be considered in order to encourage usage of urban parks that is efficient and that meets the requirements of sustainable development.

Urban park development based on sustainable spatial planning should consider economy, social and neighbourhood environment. The neighborhood environment is expected to become more livable as the ecosystem gets healthier and economic development becomes more responsive to the needs of efficient usage. In the present study, a case analysis was conducted to determine the most appropriate urban park development plan in terms of satisfying residents. In applying the case analysis, an assessment was made on the basis of efficiency in social, economic, and resource

terms. First, the domain factors of the AHP were used as an indicator for the case analysis; second, the case analysis involved resident as potential park user. Hence, the evaluation was based on the effectiveness of potential park usage. Neighbourhood satisfaction level was used as an indicator for the second assessment.

The PSPI therefore involved four parameters: area, shape, built-up volume (in regard to the volume of potential users), and proximity. The PSPI also evaluated the possibility of providing satisfaction for other neighborhoods, in cases where the built-up pixel representing a building was taken as belonging to more than one neighborhood zone. A questionnaire was used to obtain reference data in order to validate the PSPI map. The regression presented a coefficient value of 0.89, indicating a robust correlation. Hence, the result showed that PSPI worked well to assess the potential satisfaction of urban park for resident as user in terms of occupancy and accessibility.

The case analysis revealed that case 3 with 67 new urban parks including 24 existing urban parks and 43 potential parks with an SI greater than 0.448 (indicating suitability in the range from intermediate to very high), was the preferred option for achieving sustainable development of urban park. Nevertheless, certain aspects should be taken into account. The distribution of the urban park was a critical concern. In some regions, the number of urban parks located nearby was sufficient such as Tambaksari district which has the largest number of 30 urban parks, of which 27 parks are the potential site. A reduction in the number of potential sites could therefore be proposed, with some sites being transferred to areas with a smaller number of potential sites, such as Simokerto and Tegalsari districts. However, for the CBD area, three sites had very low suitability, mainly because of the long walking distance involved. Overall, this study can be used as a point of reference in plans to provide a green environment for neighborhoods and to present a positive image of the city. Additionally, the amount of 76% residents including businessmen and workers need the urban park surrounding the business centers and offices.

Keywords: urban park, site suitability, central Surabaya, sustainable development.

List of Contents

Abstract	ii
List of Contents	v
List of Figures	ix
List of Tables	xii
Acronyms / Abbreviations	xiv
Chapter 1. Introduction	1
1.1. Background and Problem Statement.....	1
1.2. Study Area and the Existing Urban Park	6
1.3. Research Objective	10
1.4. Conceptual Framework.....	10
Chapter 2. Literature Review	14
2.1. Volume of Potential User in Urban Third Dimension.....	14
2.2. Multi Criteria Decision Analysis (MCDA).....	15
2.2.1. Analytic Hierarchy Process (AHP).....	16
2.3. Urban Park and the Neighbourhood Satisfaction.....	17
Chapter 3. Methodology	20
3.1. Data Collection	20
3.2. Land Use/Land Cover (LU/LC) of the Study Area	20
3.2.1. Classification of ALOS Image.....	20
3.2.2. Selection of the Potential Site of Urban Park	27
3.3. AHP of the Potential Urban Park.....	29

3.3.1. Determination of Criteria, Sub-Criteria and Factors.....	30
3.3.2. Completion of the Pair-Wise Comparison Matrix.....	37
3.3.3. Detail Calculation of the Weight	39
3.4. Potential Satisfaction of Urban Park Index (PSPI).....	42
3.4.1. Framework and Variable of PSPI	43
3.4.1.1. The neighbourhood of urban park.....	43
3.4.1.2. Potential Satisfaction of Urban Park Index (PSPI).....	45
3.4.2. PSPI Based On the Existing Urban Park	48
3.4.2.1. Building occupancy	48
3.4.2.2. The neighbourhood of existing urban park.....	54
3.4.2.3. PSPI using the existing urban park	54
3.4.3. Validation of PSPI	57
Chapter 4. Site Suitability of the Potential Urban Park.....	61
4.1. Criteria Map Generation and Classification of Factors	66
4.1.1. Potential Accessibility	66
4.1.1.1. Volume of potential user.....	66
4.1.1.2. Walking distance to building	67
4.1.2. Surrounding Environment.....	69
4.1.2.1. Family income of user	71
4.1.2.2. Quietness.....	74
4.1.2.3. Safety	75
4.1.3. Physical Condition of Potential Site	77

4.1.3.1. Area.....	77
4.1.3.2. Shape.....	78
4.1.3.3. Distance to high voltage transmission	79
4.1.3.4. Distance to waterbody.....	81
4.1.3.5. Soil type	82
4.1.4. Economic Condition	83
4.1.4.1. Land ownership.....	83
4.1.4.2. Land value.....	85
4.2. Site Suitability of Potential Urban Park.....	87
Chapter 5. Evaluation of the Site Suitability of Potential Urban Park.....	93
5.1. The Highest and Lowest Rank Site Suitability	93
5.2. Very High Site Suitability.....	97
5.3. High Site Suitability.....	100
5.4. Intermediate Site Suitability	101
5.5. Low Site Suitability	104
5.6. Very Low Site Suitability	105
Chapter 6. Case Analysis of Sustainable Urban Park Development	107
6.1. Case Analysis Based On the Domain Factors.....	109
6.1.1. Potential Accessibility Evaluation	110
6.1.2. Environment Evaluation	115
6.1.3. Physical Condition Evaluation.....	121
6.1.4. Economic Condition Evaluation	124

6.2. Case Analysis Based on Potential Satisfaction of Urban Park Index (PSPI)	128
6.3. Implications for Sustainable Urban Park Development.....	135
Chapter 7. Conclusion	142
Acknowledgements	147
References	149
Appendix	165

List of Figures

Figure 1.1. The study area: (a) three unit developments (UDs) and eight districts included in the study area and (b) 44 villages included in the study area.	7
Figure 1.2. The distribution of the existing urban park in the district of central Surabaya	8
Figure 1.3. The conceptual framework of this study.	13
Figure 3.1. Geometric correction for ALOS: (a) distribution of GCPs, (b) ALOS image before geometric correction, (c) ALOS image after geometric correction, and (d) ALOS DSM after geometric correction.	24
Figure 3.2. Figure 3.2. (a) the 2010 LU/LC map of the study area, and (b) the photos of each LU/LC category taken during the fieldwork.	25
Figure 3.3. Selection of the potential site of urban park: (a) the field survey to identify the grassland and bareland as the potential site of urban park, and (b) distribution of potential site accross district. Note: the example of two site delineation on the orthophoto.	28
Figure 3.4. The AHP framework: (a) flowchart of AHP, and (b) the criteria, sub-criteria, and factors of the site suitability of potential urban park.	32
Figure 3.5. The framework of PSPI for each built-up pixel within the neighbourhood of urban park.	46
Figure 3.6. The building height measurement: (a) using TS instrument, (b) distribution of the 30 buildings, and the building footprint showing the measurement of one building, and (c) RMSe of generated SFH and correlation between building height (TS) and building height (SFH200). ...	51
Figure 3.7. The building occupancy (built-up volume) of study area.....	52
Figure 3.8. PSPI using the existing urban park: (a) frequency of PSPI, and (b) map of PSPI. ...	56
Figure 3.9. Validation of PSPI using a questionnaire: (a) distribution of respondent sample, (b) Correlation between PSPI class and the questionnaire (perceived satisfaction of urban park). ...	59

Figure 4.1. The concept of membership grade: (a) sigmoid and inverted sigmoid, and (b) potential accessibility sub-criteria.....	63
Figure 4.2. The membership grade of potential accessibility including: (a) volume of potential user (building occupancy - BO) and (b) walking distance to building (WD).....	68
Figure 4.3. Respondent data: (a) the distribution of questionnaire's location, (b) sex, (c) work status, (d) age and (e) education level.....	72
Figure 4.4. The membership grade of surrounding environment including: (a) family income of user (FI), and (b) quietness condition (Q).....	73
Figure 4.5. The membership grade for: (a) the safety condition of surrounding environment (S), and (b) the area of potential urban park (A).	76
Figure 4.6. The membership grade of physical condition including: (a) shape of potential site (S), and the distance to high voltage transmission (DH).	80
Figure 4.7. The membership grade of physical condition including: (a) distance to waterbody (DW), and the soil type of potential site (ST).....	84
Figure 4.8. The membership grade of economic condition including: (a) the land ownership, and (b) the land value.	86
Figure 4.9. Suitability index (SI) in cluster analysis.....	90
Figure 4.10. The map of suitability index of potential urban park.	92
Figure 5.1. The suitability index of potential urban park across the village. Note: The village number shows the village name as presented in Figure 1.1b.....	94
Figure 5.2. The surrounding area of the highest rank (ID. 61) and the lowest rank (ID.84) of the site suitability.....	96
Figure 5.3. Very high level of suitability for urban park: (a) the site 11, (b) the site 12, (c) the site 18, and (d) the site 61.....	99

Figure 5.4. The surrounding condition: (a) site ID.1 of the high suitability, (b) site ID.3 of the intermediate suitability, (c) site ID.21 and ID.65 with the low suitability, and (d) site ID.83 and ID.85 with the very low suitability.	103
Figure 6.1. Portion (%) of the closest walking distance to building.	113
Figure 6.2. The income index (level) portion in different case.....	113
Figure 6.3. The case analysis based on the hot and cold spot analysis of building occupancy (BO) regarding volume of potential user: (a) case 1, (b) case 2, (c) case 3, and (d) case 4.....	114
Figure 6.4. The quietness level across case: (a) case 1, (b) case 2, (c) case 3, and (d) case 4...	118
Figure 6.5. Number of urban park across the safety index (level) for four cases.	120
Figure 6.6. The park number according the soil type for four cases.....	120
Figure 6.7. The case analysis of the economic condition of potential site: (a) the total area of land asset and the land asset portion accross case, (b) potential site having land asset across the built-up distribution and (c) potential site for each case across the land value.	127
Figure 6.8. The case analysis based on PSPI: (a) case 1, (b) case 2, (c) case 3, and (d) case 4.	133
Figure 6.9. Pareto chart of PSPI level accros to area (in ha) and comulative frequency: (a) existing urban park, (b) case 1, (c) case 2, (d) case 3, and (e) case 4.....	134

List of Tables

Table 1.1. The existing urban park and its distribution.....	12
Table 3.1. Data used in this study.	22
Table 3.2. Accuracy assessment of LU/LC.....	26
Table 3.3. Proportions of the LU/LC.	26
Table 3.4. The experts detail.	33
Table 3.5. The comparison in numerical scale of AHP approach.....	33
Table 3.6. The value of RI	33
Table 3.7. The weight for each criterion, sub-criterion and factor for the suitability of urban park.	41
Table 3.8. The final weight of the factor for the suitability of urban park.....	41
Table 3.9. Kendall’s coefficient of factor rank.	41
Table 3.10. Percentage (%) of built-up volume across building height and number of stories. ...	53
Table 3.11. The level and percentage of PSPI using the existing urban park.....	53
Table 3.12. Confusion matrix of PSPI and perceived satisfaction of urban park.	60
Table 3.13. Chi-square test of perceived area, perceived accessibility, and perceived occupancy across the PSPI and the perceived satisfaction of urban park.....	60
Table 4.1. Suitability factors, their total weights, member function types, threshold values, and fuzzy models.	64
Table 4.2. The suitability index of potential site for urban park.....	91
Table 4.3. The membership value of upper threshold across suitability level.....	91
Table 5.1. Evaluation of the highest and lowest rank of site suitability.	95
Table 5.2. Evaluation of the very high suitable.....	95
Table 5.3. Evaluation of the high suitable.....	102
Table 5.4. Evaluation of the intermediate suitable.....	102

Table 5.5. Evaluation of the low suitable.....	102
Table 5.6. Evaluation of the very low suitable.....	102
Table 6.1. The linear regression analysis of the number of potential sites across quietness level for four cases.....	119
Table 6.2. The linear regression analysis of the number of potential sites across safety level for four cases.	119
Table 6.3. The area evaluation of new park for four cases.	119
Table 6.4. The shape (LSI) evaluation of new park for four cases.	123
Table 6.5. The evaluation of the distance to waterbody for four cases.....	123
Table 6.6. The evaluation of the distance to high voltage transmission for four cases.	123
Table 6.7. Area and portion of land asset for potential urban park.....	126
Table 6.8. Budget of land buying for each case.....	126
Table 6.9. The portion of PSPI in different cases.	132
Table 6.10. Nonparametric test and crosstabs of PSPI based on very high, high and intermediate levels across case analysis.	132
Table 6.11. The result of case analysis.....	140
Table 6.12. The number of per capita per district with the new urban park of case 3.....	140

Acronyms / Abbreviations

CBD	Central Business District
AHP	Analytic Hierarchy Process
PSPI	Potential Satisfaction of Urban Park Index
SI	Suitability Index
UN	United Nations
WCED	World Commission on Environment and Development
LSA	Land Suitability Analysis
GIS	Geographic Information System
RS	Remote Sensing
BO	Building Occupancy
UD	Unit Development
DSM	Digital Surface Model
LiDAR	Light Detection and Ranging
ALOS	Advanced Land-Observing Satellite
MCDA	Multi Criteria Decision Analysis
GI	Green Index
LU/LC	Land Use/Land Cover
JAXA	Japan Aerospace Exploration Agency
UTM	Universal Transverse Mercator
GCPs	Ground Control Points
RMSe	Root Mean Square error
KBS	Kebun Binatang Surabaya
CR	Consistency Ratio
CI	Confidence Interval

LSI	Landscape Shape Index
ANGSt	Accessible Natural Greenspace Standards
FLG	First Law of Geography
OA	Overall Accuracy
DTM	Digital Terrain Model
EBK	Empirical Bayesian Kriging
SFH	Surface Feature Height
TS	Total Station
K [^]	Kappa coefficient
OE	Omission Error
CE	Commission Error
WD	Walking Distance
A	Area of potential site
DW	Distance to Water body
LO	Land Ownership
FI	Family Income of user
Q	Quietness
SF	Safety
S	Shape of potential site
DH	Distance to High voltage transmission
ST	Soil Type
FAO	Food and Agriculture Organization of the United Nations
CSR	Corporate Social Responsibility