Institutional model for ecotourism development in the Gunung Pongkor post-mining area

A Kusumoarto1, A Gunawan2, Machfud3 and A Hikmat4

1Lecturer in Architecture Study Program, University of Indraprasta PGRI, Jl. Raya Nangka No. 58C, RT.5/RW.5, Tanjung Barat, Kecamatan Jagakarsa, Kota Jakarta Selatan, Daerah Khusus Ibukota Jakarta 12530
2Lecturer in Landscape Architecture Department, IPB University, Jl. Raya Darmaga, Bogor, Indonesia 16680
3Lecturer in AgroIndustrial Technology Department, IPB University, Jl. Raya Darmaga, Bogor, Indonesia 16680.
4Lecturer in Forest Resources Conservation and Ecotourism Department, IPB University, Jl. Raya Darmaga, Bogor, Indonesia 16680

Email: andrianto.kusumoarto@unindra.ac.id

Abstract. The Gunung Pongkor post-mining area has some resources potential for ecotourism destination. The development of area's ecosystem in the Gunung Pongkor post-mining area needs to protect the ecosystem and prevent activities that do damage within the area. In this case, it is necessary to make institutional model for ecotourism development in the Gunung Pongkor post-mining area. The objectives of this study are 1) to identify the elements in the development structure variable; 2) to analyze objective variables, needs variables, constraint variables, and actor variables; 3) to create institutional model for ecotourism development in the Gunung Pongkor post-mining area. This study uses descriptive qualitative methods with Interpretive Structural Modelling (ISM) analysis. The elements analyzed are 1) the objectives to be achieved in the development of the ecotourism areas, 2) the needs in the development of the ecotourism areas, 3) the obstacles that need to be overcome, and 4) the actors who play a role in the development of the ecotourism areas. The key element of the goal for ecotourism development in the Gunung Pongkor post-mining area is to provide education to the local community about environmental management and culture. In the development process, a master plan and legality of the area as ecotourism are needed. Some of the main obstacles in the development of this area are the absence of a change in the status of a forest area to an ecotourism area and a lack of knowledge about the conservation of natural resources and the environment. The key actors needed in developing this area are Regional Planning, Research, and Development Agency of Bogor Regency Regional Government, Tourism and Culture Office of Bogor Regency Regional Government, Environmental Office of Bogor Regency Regional Government. The diversity of the existing potential is utilized to the fullest it resolves problem that occur in this area in achieving an ecotourism area based on landscape characters in the Gunung Pongkor post-mining through collaborative ecotourism development.

Keywords: ecotourism planning and design, interpretive structural modeling, landscape development and management, mining reclamation.

1. Introduction

The Gunung Pongkor post-mining area has ecotourism objects potential, landscape character potential of lowland forest, visual aesthetics of the landscape character potential, and potential area as a habitat for flora and fauna [1]; [2]; [3]. In this area, there is also mine buildings and tailings storage facilities that could potentially be heritage materials. Some areas are used by the community for social and economic activities to become an attraction for activities and culture. Areas that are developed into ecotourism areas are in an
excellent category if they have biophysical potential, cultural potential, visual aesthetic potential, historical heritage buildings potential, and biodiversity potential [4];[5];[6]. Ecotourism activities can provide economic benefits for the community and local government [7].

The development of an ecotourism area in the Gunung Pongkor post-mining area needs to protect the ecosystem, prevent damage in the area, prevent land-use change, protect ecotourism activities, organize and protect the facilities of ecotourism objects, and protect the visual quality of natural resources. Two of the six principles put forward by [8] that must be met in the implementation of ecotourism are related to the sustainability of the destination, namely: (1) as much as possible eliminating the negative impact of the presence of visitors on the ecotourism destination environment and residents; (2) participate in helping maximize the early and long-term participation of local communities in the decision-making process concerning the implementation of ecotourism. Sustainable ecotourism development policies need to carry out: (1) institutional arrangements; (2) setting policies to protect biodiversity in the context of ecotourism sustainability; (3) policies in protecting local uniqueness and participation of local communities; (4) policies in the protection and development of local culture; and (5) policies in the use of ecotourism resources that can provide economic benefits for local communities in particular and increase income for local governments in general [9]. The development of an ecotourism area in the Gunung Pongkor post-mining area requires institutional model based on expert perceptions. The objectives of this study are 1) to identify the elements in the development structure variable; 2) to analyze objective variables, needs variables, constraint variables, and actor variables; 3) to create institutional model for ecotourism development in the Gunung Pongkor post-mining area.

2. Methodology
The study was conducted in the Gold Mining Business Unit of Pongkor (GMBUP), at 9266297 North Latitude - 9263636 South Latitude and 673097 West Longitude - 674746 East Longitude UTM (Universal Transverse Mercator). The study was conducted from January 2018 to December 2018.

The method used in this research is descriptive qualitative with interpretive structural modeling (ISM) analysis. The elements analyzed are 1) the objectives to be achieved in the development of the ecotourism areas, 2) the needs in the development of the ecotourism areas, 3) the obstacles that need to be overcome, and 4) the actors who play a role in the development of the ecotourism areas.

2.1. Research Data Collection
Data collection methods consisted of literature studies, surveys, and interviews with experts. Primary data is obtained directly from interviews with stakeholders and experts. Secondary data were obtained through literature studies.

2.2. Data Analysis
This method is carried out in two stages. The first stage identifies the key stakeholders. The second stage, determining several key factors obtained from need analysis, which is reviewed through expert discussions and based on the theory of the ecotourism system.

Initial stakeholder information is obtained through the snowball method where stakeholder recommend other stakeholder as respondents [10]. Identification of needs and aspirations of each stakeholder according to the priority scale is carried out after identifying
the stakeholders [11]. The identification of stakeholders is done by identifying community leaders and managers of the Gunung Pongkor post-mining area who play a role in the development of the ecotourism in the Gunung Pongkor post-mining area. The needs and aspirations of each stakeholder are then discussed together with experts to find critical stakeholders. Expert determination is based on considerations and criteria put forward by [12] due to differences of opinion [13]. Each selected expert has knowledge in the fields of ecotourism, ecotourism economics, social and institutional sciences, natural resources and environmental management, and regional planning. The main activities carried out are as follows: 1) to identify and map key stakeholders and their roles related to regional development, 2) identify the relationships among stakeholders, 3) to identify the elements related to ISM analysis, 4) to identify the institutions related to research.

The ISM analysis stage is the determination of contextual relationships, which are then converted into mathematical relationships. The relationship between elements fulfills reflexive and transitive properties [14]. In the process of transforming the contextual relationship (structural self-interaction matrix) into a mathematical relationship in the form of a reachability matrix with complete rules (Table 1) [15]. The determination of sub-elements is carried out through focus group discussions (FGD) of stakeholders involved in area management until a compromise is reached (Table 2).

### Table 1. Transformation of Contextual Relationships between Elements Into Mathematical Relationships

| Symbols | Definitions | SSIM |
|---------|-------------|------|
| V       | if sub-element i has a contextual relation to sub-element j, but sub-element j has no contextual relation with to sub-element i | $e_{ij} = 1$ and $e_{ji} = 0$ |
| A       | if sub-element i has no contextual relation to sub-element j, but sub-element j has a contextual relation to sub-element i | $e_{ij} = 0$ and $e_{ji} = 1$ |
| X       | if sub-element i has a contextual relation to sub-element j, and vice versa | $e_{ij} = 1$ and $e_{ji} = 1$ |
| O       | if sub-element i has no contextual relation to sub-element j, and vice versa | $e_{ij} = 0$ and $e_{ji} = 0$ |

### Table 2. The Elements of the Ecotourism Development System

| The elements   | The contextual relationships |
|----------------|-----------------------------|
| The Objective  | The one objective sub-element contributes to the achievement of another objective sub element. |
| The Need       | The one sub-element of needs supports the fulfillment of other sub elements of needs. |
| The Constraint | The one constraint sub-element causes another constraint sub element. |
| The Actor      | The one actor sub-element needs the support of another actor sub element. |

2.2.1. Analysis of Interpretive Structural Modeling (ISM)

The ISM analysis with the ISM-VAXO method goes through the following stages: 1) preparation of the Structured Self-Interaction Matrix (SSIM), in modeling with ISM, opinions or assessments of contextual relationships of elements are expressed in the symbols of V, A, X, O; 2) transformation of the SSIM matrix into a reachability matrix (RM) where the contextual relationship between sub-elements in the form of a matrix whose cells are in the form of letters (VAXO) is transformed into a binary number
reachability matrix; 3) testing and transformation of the reachability matrix, namely the reachability matrix, if the Boolean operation meets the reflexive and transitive requirements, if not, an adjustment is made by performing a recursive multiplication operation so that a closed matrix condition (causal looping) is formed.

2.2.2. The Classification of Sub-element
The sub-element classification is determined by the level of each sub-element with the following rules: 1) create a reachability matrix after going through the transitivity stage; 2) determine the level of each sub-element by first determining the reachability (horizontally for the sub element with value 1); 3) determine the antecedent (vertically for the sub-element with value 1); 4) specify the intersection (same value); 5) if the reachability and intersection values are the same, then the level of these sub-elements can be determined; 6) remove the sub-elements whose levels are known; 7) Repeat the procedure until all the sub-elements are leveled.

3. Result

3.1. The Objectives to be Achieved in the Development of the Ecotourism Areas in the Gunung Pongkor Post-Mining Area
Providing education to the local community about environmental management and about the culture are vital factors as the highest driving factor in the development of ecotourism (Figure 1a). Conserving living natural resources and their ecosystems and improving the community's welfare has the power as a high driving factor, but has a high enough dependency. Protecting against potential parks has a high dependence and has a high enough driving force. Increasing the active role and independence of the community has a fairly weak dependency and has a strong enough driving force. Protecting vital national objects has a high dependence and has a high enough driving force. Exploiting natural resource potential has a high dependency and has low driving factors (Figure 1b).

![Diagram](a)

![Diagram](b)

where:
1: conservation of living natural resources and their ecosystems; 2: exploitation of natural potential; 3: protection against potential parks; 4: protection of national vital objects; 5: provide education to the local community about environmental management; 6: provide education to the local community about the culture; 7: increasing the active role and independence of the community in ecotourism activities; 8: improve community’s welfare; I: autonomous barrier; II: dependent barrier; III: linkage barrier; IV: independent (driver) barrier

**Figure 1** The Hierarchy of Objectives for Ecotourism Development in the *Gunung Pongkor* Post-Mining Area (a); the Driving Factors and the Dependency Factors of Each Objective (b)
3.2. The Needs in the Development of the Ecotourism Areas in the Gunung Pongkor Post-Mining Area

Critical factors of need are the existence of a master plan document and legality for the ecotourism area (Figure 2a). Both of these needs have the strength as a highly motivating factor for the fulfillment of other needs. Besides, it also encourages the formation of the need for ecotourism area management. The need to improve accessibility to ecotourism areas, the need for increased skills and human resource capacity for ecotourism management, and the need for facilities and infrastructure are three needs that have strength as a high driving factor that encourages the fulfillment of investors needs. Investors’ needs for ecotourism development in this area are highly dependent on the fulfillment of other needs (Figure 2b).

Figure 2 The Hierarchy of Needs for Ecotourism Development in the Gunung Pongkor Post-Mining Area (a); the Driving Factor and the Dependency Factor of Each Need (b)

3.3. The Constraints in the Development of the Ecotourism Areas in the Gunung Pongkor Post-Mining Area

The critical constraint factors are the absence of a change in the forest area’s status to an ecotourism area and a lack of knowledge about the conservation of natural resources and the environment (Figure 3a). Both of these constraints have the highest dependencies and have the lowest strengths as driving factors. These obstacles are due to the limited human resources who have knowledge, skills, and professionalism in ecotourism management. The fundamental thing is that there is no change in the forest area’s status to an ecotourism area and there is a lack of knowledge about the conservation of natural resources and the environment (Figure 3b).
where:
1: there has been no change in the business of ex-illegal miners to the tourism business; 2: limited human resources who have knowledge, skills, and professionalism in ecotourism management; 3: lack of adequate facilities and infrastructure; 4: there has been no change in the forest area's status to an ecotourism area; 5: lack of knowledge about the conservation of natural resources and the environment; I: autonomous barrier; II: dependent barrier; III: linkage barrier; IV: independent (driver) barrier

**Figure 3** The Hierarchy of Constraints for Ecotourism Development in the *Gunung Pongkor* Post-Mining Area (a); the Driving Factor and the Dependency Factor of Each Constraint (b)

### 3.4. The Actors in the Development of the Ecotourism Areas in Gunung Pongkor Post-Mining Area

The key actors involved in developing the ecotourism area in the *Gunung Pongkor* post-mining area are Regional Planning, Research, and Development Agency (*Bappelitbangda*), Tourism and Culture Office (*Dinas Pariwisata dan Kebudayaan*), and Environmental Office (*Dinas Lingkungan Hidup*), Bogor Regency Regional Government. (Figure 4a). Regional Planning, Research, and Development Agency of Bogor Regency Regional Government has the strength as a highest driving factor and has a high dependence on other actors (middle level). Tourism and Culture Office and Environmental Office of Bogor Regency Regional Government are the second institutions that have the power as a driving factor but have high dependencies (Figure 4b).

The Regional Leadership Consultative Forum (*Muspida*) of Bogor Regency Regional Government has a high driving force and has a high dependency. The Ministry of Environment and Forestry has a high dependency and power as a high driving factor. *PT. Aneka Tambang Tbk*, has a high dependence and has strength as a high driving factor. This company also supports to higher education institutions to carry out planning, research, development, and empowerment of communities around the area.
where:
1: Regional Planning, Research, and Development Agency of Bogor Regency Regional Government; 2: Tourism and Culture Office of Bogor Regency Regional Government; 3: Environmental Office of Bogor Regency Regional Government; 4: PT. Aneka Tambang Tbk.; 5: Higher Education Institutions; 6: Ministry of Environment and Forestry; 7: The Regional Leadership Consultative Forum of Bogor Regency Regional Government; I: autonomous barrier; II: dependent barrier; III: linkage barrier; IV: independent (driver) barrier

Figure 4 The Hierarchy of Actors for Ecotourism Development in the Gunung Pongkor Post-Mining Area (a); the Driving Factors and Dependency Factors of Each Actor (b)

3.5. The Institutional Model for Ecotourism Development in Gunung Pongkor Post-Mining Area

The development of an ecotourism area to achieve the desired goals requires an institutional model in the form of “Collaborative Ecotourism Development”. The seven actors, as described above, have contributed by their respective objectives with the principles of the protection and development of sustainable ecotourism in the Gunung Pongkor post-mining area. The actors collaborate in meeting the needs and overcoming obstacles for ecotourism development. The institutional model, as proposed, does not take over the role of PT. Aneka Tambang, Tbk. The institutional model aims to protect and manage the area so that the area can be characterized, sustainable, safe, and comfortable in the use of limited activities [16].

4. Conclusion

In the process of developing the area into an ecotourism area, the aim of providing education to the local community about environmental management and the culture is a critical element. In the development process, a master plan is needed and the area's legality as an ecotourism area. There are several obstacles in developing this area, especially the absence of a change in status from a forest area to an ecotourism area and a lack of knowledge about the conservation of natural resources and the environment. The key actors needed in developing this area are the Regional Planning, Research, and Development Agency of Bogor Regency Regional Government, Tourism and Culture Office of Bogor Regency Regional Government, and the Environmental Office of Bogor Regency Bogor Government. The diversity of the existing potential is utilized to the maximum extent possible to achieve an ecotourism area based on landscape characters in the Gunung Pongkor post-mining area through Collaborative Ecotourism Development.

Reference
[1] Kusumoarto A, Gunawan A, Machfud & Hikmat A 2017 Landscape Character of Pongkor Mining Ecotourism Area in : Kaswanto RL, Mugnisjah WQ, Arifin HS, Ismail NA, & Kobayashi T, editor 2nd International Symposium for Sustainable Landscape Development; 2016 November 9-10; Bogor, Indonesia Bogor (ID): IOP Publ., pp 012028. Doi: 10.1088/1755-1315/91/1/012028.
[2] Kusumoarto A, Gunawan A, Machfud & Hikmat A 2019 Visual Aesthetic Analysis of Post-Mining Area For Ecotourism Destination AES Bioflux, 11 (3): 133-158.
[3] Kusumoarto A, Gunawan A, Machfud & Hikmat A 2020 The Biodiversity of Flora and Fauna in the Re-vegetation Area in The Post-Mining Area of Pongkor 4th International Symposium for Sustainable Landscape Development; 2019 October 10; Bogor, Indonesia Bogor (ID): IOP Publ., pp 012035. Doi: 10.1088/1755-1315/879/1/012035.

[4] Avenzora R 2008 Ekoturisme : Evaluasi Tentang Konsep Avenzora R, editor NAD-Nias (ID): BRR NAD-Nias.

[5] Gunn C A 1994 Tourism Planning : Basics, Concepts, and Cases Third Edition (London (UK): Taylor & Francis Ltd).

[6] Kusumoarto A & Ramadhan R 2016 Ecotourism and Suitability Evaluation of the Mount Salak Resort II in the Halimun-Salak National Park In Radzi et al. (ed). Heritage, Culture, and Society London (UK): Taylor & Francis Group pp 831.

[7] Jeyacheya J & Hampton MP 2020 Wishful thinking or wise policy? Theorising teorism-led inclusive growth: Supply chains and host communities World Development, 131: 1-12 Doi: 10.1016/j.worlddev.2020.104960.

[8] Fennel D & Eagles P F J 1990 Ecotourism in Costa Rica : A Conceptual Framework Journal of Park and Recreation Administration, 8(1): 3-34.

[9] Fennel D A & Dowling RK 2003 Ecotourism Policy and Planning London (UK): CABI Publ.

[10] Dunn W 2003 Methods of The Second Type : Coping with The Wilderness of Conventional Policy Analysis Policy Studies Review, 7:720-737.

[11] Wondirad A, Tolkach D, & King B 2020 Stakeholder collaboration as a major factor for sustainable ecotourism development in developing countries Tourism Management, 78: 1-21 Doi: 10.1016/j.tourman.2019.104024.

[12] Eriyatno & Sofyan F 2007 Riset Kebijakan Metodologi Penelitian Untuk Pasca Sarjana Bogor (ID): Institut Pertanian Bogor Press.

[13] Motlagh EY, Hajjarian M, Zadeh OH, Alijanpour A 2020 The difference of expert opinion on the forest-based ecotourism development in developed countries and Iran Land Use Policy, 94: 1-9 Doi: 10.1016/j.landusepol.2020.104549.

[14] Machfud 2001 Rekayasa Model Penunjang Keputusan Kelompok dengan Fuzzy Logic untuk Sistem Pengembangan Agroindustri Minyak Atsiri [disertasi] Bogor (ID): Institut Pertanian Bogor.

[15] Saxena JP, Sushil, Vrat P 1992 Hierarchy and classification of program plant elements using interpretive structural modeling: a case study of energy conservation in the Indian cement industry Syst.Pract, 5(6): 651-670.

[16] Rios CA, Amoroco R, Villarreal CA, Mantilla W, Velandia FA, Castellanos OM, Munoz SI, Atuesta DA, Jerez JH, Acevedo O, Vargas M, Caballero VM, Goso CA, Briggs A 2020 Chicamocha Canyon Geopark project: A novel strategy for the socio-economic development of Santander (Colombia) through geoeucation, geotourism and geoconservation International Journal of Geoheritage and Parks, 8: 96-122 Doi: 10.1016/j/ijgeop.2020.05.002.