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Journal Aims

IJSH aims to facilitate and support research related to smart home technology and its applications.

Our Journal provides a chance for academic and industry professionals to discuss recent progress in the area of smart home.

To bridge the gap of users who do not have access to major databases where one should pay for every downloaded article; this online publication platform is open to all readers as part of our commitment to global scientific society.

Journal Topics

The topics covered by IJSH include the following:-

SH Applications:

- Commercial and industrial application for SH
- Context awareness model for smart home services

- Semantic Knowledge Management and Services in SH
- Semantic Technologies for SH
- Smart home (Building) applications and services
- Smart home network middleware and protocols
- Wireless sensor networks (WSN) / RFID application for SH

SH Security:

- Access control and privacy protection in SH
- Forensics and Security Policy in SH
- Multimedia Security and Services in SH
- Security Protocol for smart home service
- Smart home security issues and model
- WSN / RFID Security in SH

SH Embedded Hardware and Software:

- Embedded Hardware Support for SH
- Embedded Software for SH
- Embedded System Architecture for SH
- Middleware for SH
- Power-Aware Computing for SH
- Real-time OS for SH
- Smart and Personal Devices for SH
- Specification, Validation and Verification of Embedded Software

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Foreword and Editorial

International Journal of Smart Home

We are very happy to publish this issue of an International Journal of Smart Home by Science & Engineering Research Support soCietY.

This issue contains 32 articles. Achieving such a high quality of papers would have been impossible without the huge work that was undertaken by the Editorial Board members and External Reviewers. We take this opportunity to thank them for their great support and cooperation.

The paper “The Study of Current Mode Rectifier Control Technology” analyzed PWM converter with current mode control is analyzed and designed. Moreover, a loop-locked control strategy is put forward based on dq coordinate conversion to SVPWM converters in the power accumulator battery testing system. Low ripple and fast response testing current in a wide adjustable range is achieved, and high power factor is obtained. Considering resonance of LC filter, the passive damping is designed, which is based on the series resistance of capacitor. Simulation results verify the feasibility and validity of this strategy.

The paper “A Peer Management Policy for Energy Efficiency in Mobile P2P Networks” suggests a peer management policy for mobile P2P environments with high degrees of mobility which is designed to increase the efficiency of data transmission by taking sufficiently into account network characteristics and energy efficiency of mobile devices.

The paper “Low Carbon Scheduling with Iterative Ant Colony Algorithm” considers a low carbon scheduling problem in unrelated parallel machines. To solve this problem, they first establish a low carbon scheduling mathematical model. Then an iterative ant optimization algorithm is presented. Furthermore, parameters of proposed iterative ant optimization algorithm are selected by Taguchi methods on generating test dataset. Finally, comparative experiments indicate the proposed iterative ant optimization algorithm has better performance on minimizing energy consumption as well as total tardiness.

In the paper “An Inexact Two-Stage Stochastic Programming Model for Sustainable Utilization of Water Resource in Dalian City”, an inexact two-stage stochastic programming model was applied to sustainable utilization of water resource under uncertainty in Dalian city. The developed model, integrated the two-stage stochastic programming and inexact optimization, could deal with uncertain problems expressed as probability distributions and discrete intervals. After formulating the model, a hypothetical case based on the comprehensive planning of sustainable utilization of water resource in Dalian city was employed for demonstrating its application in the three different planning year, which was 2015, 2020, 2030. The optimal allocation of water resource with maximized system benefit among different users had been obtained.

The paper “Agent-Based Context-Aware Architecture for a Smart Living Room” states that technology that is moving beyond the personal computer towards a trend of embedded microprocessors in everyday objects and home appliances. The recent advances in sensor networks and devices with computing ability have provided us the necessary technology to make smart spaces. In such spaces, user activity and behavior are taken into account in order to provide adequate and accurate adapted services to the

current context. Services are provided proactively (without explicit user intervention) and in an unobtrusive manner. The main objective of smart spaces is to provide services to the user for improved comfort, energy savings, security, and tremendous benefits for elderly persons living alone or persons with disabilities. Despite the interesting number of proposed architecture for building smart spaces, there still exists a lack of a generic software architecture for the development of such spaces. The major weakness of proposed architecture is that they have not dealt in depth with context-awareness, which is a key feature especially in context-aware services adaptation in smart spaces. In this paper, they propose a multi-agent architecture for building a smart living room with a focus on context-awareness aspects. The proposed architecture is generic enough to be easily used in any smart space.

In the study “Experimental Research on the Influence of Tool Material and Geometric Parameters on Cutting Surface Quality of Super Alloy”, for nickel base superalloy GH4169 that is investigated in the process of machining tool is easy to wear, cold-setting severe deformation, surface quality is difficult to guarantee and so on, using different carbide cutting tools and different tool geometry parameters, nickel-based superalloy GH4169 be turning experiments. The cutting tool material, cutting tool rake angle and corner radius of the influence law of super alloy surface roughness, different tool wear condition analysis. Results show that using K313, KC5510, SM1105 three kinds of cutting tool materials processing, the difference of obtained surface roughness is not big, but for the tool wear condition, the rake face and rear face wear of KC5510 is small. Integrated tool wear and workpiece machined surface quality, in the selection of the four tool materials, KC5510 is more suitable for processing GH4169; Single factor experiments found that with the gradual increase in rake angle and the corner radius, the surface roughness gradually decreases. Therefore, when GH4169 be turning, in order to reduce the surface roughness, grain refinement should be used, together with the PVD TiAlN coating carbide cutting tools, while a larger rake angle and corner radius are selected.

The research work “Techno-Economic Evaluation of the Centralized Hybrid Renewable Energy Systems for Off-Grid Rural Electrification” will provide an assessment of the renewable energy potential of the Baluchistan region. A comparison of the economic and financial analysis for a centralized hybrid renewable energy system has been simulated by using Homer software. Three cases have been proposed in which centralized standalone solar PV system, centralized standalone wind energy system and a hybrid combination of both centralized standalone solar and wind energy system have been studied. Homer software has been used to devise the most optimal solution.

The study “Design and Implementation of Livestock House Environmental Perception System Based on Wireless Sensor Networks” designs a set of livestock house(LH) environmental perception system based on wireless sensor networks in order to monitor the six factors which is the most crucial influence on livestock production in livestock house, this paper. This system is composed by a number of data acquisition nodes(DAN) connected by using Wireless Sensor Networks. Inside of DAN is equipped with six type of sensor which in charge of collecting Real-time environmental data in LH, including carbon dioxide sensor, ammonia gas sensor, illumination sensor, relative humidity sensor and so on. The communication mode between upper-computer and central node is GPRS, to research on remotely control environmental parameters in LH in the future. The upper-computer could treat data which is uploaded by several central nodes through some way, for example, data analysis based on established protocol, threshold judgment, etc. Then, the real-time data is stored by database. The stability and veracity of the system was verified by field tests which set technical grade monitors as control groups. Comparing

with industrial-grade high precision monitoring instruments, the error of collecting data and wireless communication network is within normal error range, By SPSS, the result shows that there is no significant difference of P-Value($P>0.05$) in different groups at same time.

Authors of the paper “Study on Multi Objective Optimization Method and It Application in Aviation and Deceleration Device” propose a new multi-objective differential evolution (MODE) variant, named improved double population differential cultural particle swarm optimization algorithm, inspired by improved strategy based on algorithm fusion. From the characteristics of cultural algorithm and particle swarm optimization (psa) algorithm, considering the advantages and disadvantages of both algorithms have strong complementarily. In the process of the evolution of the belief space, the strategy of "multi - layer space, the best choice" is adopted. In the process of the evolution of the group space, using the improved double group evolution difference method. To avoid a large number of high fitness infeasible solutions are discarded and the results of the algorithm are not ideal, and the convergence speed of the algorithm is improved. Multi objective optimization design of micro small speed reduction device for Aviation Based on CPSA. By comparison with the original design, the characteristics of the new design scheme are greatly improved. It is suggested that this paper proposed the method of multi objective optimization design based on the improved double population differential and multi layer culture particle swarm optimization is feasible.

The paper “Research on the Development Efficiency of Family Farm based on DEA Model: A Case Study” first describes the individual characteristics of the family farm operators, the size of the land and the circulation of the farm, the situation of the farm to obtain funds and information services. Then they estimate the development efficiency based on the DEA model, by using the survey data. The results show that family farm business process is lack of new agricultural technologies; family farmers’ management ability is weak, the factors of production inputs such as unreasonable causes share of the family farm in Northeast DEA efficiency is low. In order to develop the efficiency of the family farm, government should put forward and optimize the land circulation system, pay attention to the quality of the family farmers, and improve the agricultural technology extension system, optimize the allocation of production factors.

The paper “Improvement Metaheuristic for the Time Dependent Vehicle Routing Problem Based on Simulated Annealing” defines time dependent vehicle routing problem (TDVRP) as a vehicle fleet of fixed capacities serves customers of fixed demands from a central depot with consideration of road networks conditions. The travel time between two customers or between customer and the depot depends on the distance of the two points and time of a day. A mathematical model is formulated for the TDVRP problem and a simulated annealing (SA) based improvement method is proposed for solving it. The main objective is to minimize the number of vehicles and the second objective is to minimize the total travel distance of the vehicles. The proposed approach was tested on the 56 test problems with 100 customers from Figliozzi’s benchmark, and results show that the improvement metaheuristic could get better solutions than Figliozzi’s algorithm in the different time dependent speeds function within an accepted computational time.

In the paper entitled “Study on a Novel Data Classification Method Based on Improved GA and SVM Model” introduced an improved genetic algorithm(IGA) in order to propose a new classification(IGASVM) method based on combining improved GA and SVM model. In the proposed IGASVM method, the self-adaptive control parameter strategy and improving convergence speed strategy are introduced into the GA to keep the diversity of the population, promptly reflect the premature convergence of the individual

and escape from the local optimal solution for improving the search performance. Then the improved GA is used to optimize and determine the parameters of the SVM model in order to improve the learning ability and generalization ability of the SVM model for obtaining new classification (IGASVM) method. Finally, the experiment data is selected to test the effectiveness of the proposed IGASVM method.

Paper “Geotourism as a Strategy of Geosite Empowerment Towards the Tourism Sustainability in Gunungkidul Regency, Indonesia” talks about the enactment of the region of Mount Sewu as a Global Geopark Network (GNN) on 19 September 2015 has given a responsibility for governments and communities to develop this region with a proper concept. The karst of Mount Sewu surrounding the Gunungkidul Regency, Wonogiri Regency and Pacitan Regency is one of the most well-known karst regions in Java Island for its uniqueness. Geoheritage and social-cultural wealth in this region becomes the base of its enactment as GGN. This study presents geotourism as a strategy of geosite empowerment towards the tourism sustainability in Gunungkidul regency. It is found that the Geotourism development comes to be an appropriate strategy in developing 13 geosites in Gunungkidul for fulfilling the directive of the policy on the local and national tourism development, demands of the development trend towards the tourism interest among community and the directive of GGN in accordance with the concept as outlined in UNESCO. The directive of the development of this geotourism has been formulated through a synthesis of various analyses including the analysis of government, analysis of potential tourist attraction, and SWOT analysis. The dialogue from a variety of analyses required to produce the formula of geotourism development of various analyses is needed to guarantee the production of a formulation of the proper and synergic directive for the geotourism development analysis necessary to guarantee the formulation of appropriate and synergic Geotourism development with various existing development guidelines.

Authors of the paper “The Synchronization Design and Implementation of LTE-Advanced Real-Time Test Platform Based on Software Defined Radio” choose GNU Radio and Universal Software Radio Peripheral (USRP) to construct a test platform for mobile communication technologies based on SDR. With the platform, a real communication conforming to LTE-Advanced physical layer specification is implemented by the PSS/SSS of LTE radio frame. The platform provides a tool to design, test and verify mobile communication technologies in real environment.

The study “UAV Remote Sensing Image Mosaic and Its Application in Agriculture” discusses the application of remote sensing image in agriculture, including rice lodging monitoring, diseases and pests monitoring, crop growth monitoring and crop nutrient diagnosis.

The paper “System Management of Human Object on the Industrial Safety” studies management issues in wireless body area network for industry safety. They design human object as wireless body area network on the employee’s body and propose management method for industry safety.

The study “Research on the Application of Building Information Model Technology in the Design of Urban Residential Buildings in Cold Region” is based on the engineering projects; the planning, the design of building facade, collision detection optimization and the full participation of construction cost control in building information model provide a new train of thoughts and research reference for the residential design in cold region, in the context of the digital age, and to a certain extent, the study looks forward to the future urban residential design and construction industrialization prospect in the cold region .

Building information modeling technology improves the design efficiency and quality with its precise data processing and analysis, avoids the defects in design and the material waste of construction and environment pollution, significantly enhancing the pre-processing level of construction structure parts, which is in line with the energy-saving environmental protection and rural environmental construction philosophy advocated by the state, and the green building strategies of sustainable development.

Authors of the paper “Research on the Localization Algorithm of Transmitting Station Based on RSSI and GPS” presents an intelligent positioning algorithm for transmitting station. By using GPS and RSSI, the influence of RSSI value can be reduced. The advantages of multi angle positioning method and centroid localization method are combined. The algorithm required less precision positioning device, also the least square method is used to reduce the error of location in urban areas. The method is simple and convenient, and the simulation results show the practicability of the algorithm.

The paper “Analysis and Design of Gravitational Sub-Pumping Station” presents an analysis in the design of gravitational sub-pumping station in riverside road to assist the existing pumping station in that locality. Such a design can serve as a model that can be implemented to the other sections of the city. The design of this pumping station involved investigating the existing sub-pumping station in terms of its structure, financial resources, and the effect in the health of end-users, its maintenance including the traffic, operations and reduction of flood water. A conventional gravitational sub-pumping station was designed based on the conclusion that for the city of Taguig, a uniform, consistent, simple pumping station would be the most.

The paper “On Research IoT-based Intelligent Parking Management System and Its Design” introduces a Internet of Things (IoT)-based intelligent parking management system, innovatively proposes a non-source RFID card that utilizes label and sensor binding to actualize vehicle identification and to accomplish functions of vehicle entrance & exit authentication, automatic charging, and parking lot certification, eventually further enhancing the utilization, traffic efficiency and service level of parking places.

In the paper “Performance Analysis of Fuzzy based RED for Congestion Control in MANET”, the active queue management (AQM) scheme i.e. random early detection (RED) AQM algorithm is modified using fuzzy logic MATLAB tool, in such a manner that the efficient and reliable performance of the network can be maintained and improved as well. The results are verified with the help of QualNet 6.1 network simulator.

In the study “Research on the Characteristics of Tourism Consumption Based on Network Data: A Urban-rural Perspective”, with the rapid development of online travel industry in their country, more and more tourists begin to get travel information, booking travel products through the network. The author first analyzes the characteristics of tourism consumption demand, and finds out the key factors affecting tourism consumption based on urban and rural areas.

Authors of “Research on the Seismic Design of High-rise Steel Building Based on Security Perspective” analyze the seismic performance of high rise buildings by using finite element modeling, dynamic and static analysis. Through the static analysis of steel structure that combined with dead load, live load and wind load, the result shows that when steel support under the force, the maximum node stress mainly appears in the low-end and the ninth layer, which is located in 19, 22 axis node stress is the largest, respectively as 65.9Mpa, 62.6Mpa, it is safety and within the strength limit.

The paper “Research on the Influencing Factors of College Sports Teaching Based on Statistical Analysis” talks about the rapid progress of technology, the society puts forward higher requirements for talent cultivation. The sport teaching emphasizes student’s sports experience and participation, the course content is wider, including physical, psychological and emotional health. In previous studies, people don’t pay much attention to the sports teaching environment, lack of evaluation of sports teaching environment. In this paper, they first analyze the evaluation standard of classroom teaching quality, and then they analyze the factors that will influence physical education.

The study “Fault Diagnosis of Coal Mine Equipment Based on Improved GA Optimized BP Neural Network” uses chaos and reverse individual learning initialization, followed by the use of differential algorithm to operate on the optimal individual. Finally, the improved fitness function is applied to the selection operation, and the accuracy of operation is improved by mutation probability and crossover probability. The improved algorithm is applied to the BP neural network to improve the training effect.

In the study “A Hybrid Framework for Adaptive Protection of Microgrids Based on IEC 61850”, a hybrid adaptive protection scheme has been proposed for protection of microgrids. Computational burden and data storage is distributed among the local controllers and the central controller. A gateway is proposed for communicating between the serial interfaced devices and the IEC 61850 process bus. Finally, a framework has been introduced for implementing the proposed hybrid protection scheme for adaptive protection of microgrids by using IEC 61850-based intelligent electronic devices (IEDs).

The paper “Analysis on the Digging of Social Network Based on User Search Behavior” comes up with social network behavior search algorithm based on Hadoop Cloud Computing, which mainly adds impact factors, time arrow and page correlation factors into digging factors so as to improve the performance of digging computing and the search efficiency. The experiment proves that the computing has good effect and has instructive significance for user analysis of Cloud Computing.

The paper “A Novel Man-Machine Command System”, talks about embedded system, man-machine command system is the main way for people to use the system. The command in man-machine system often needs upgrade. It is a hard work to upgrade the old command with the new version of the command. A novel man-machine command system proposed in this paper can be used to upgrade the command system in a smooth way. The method comprises: split the embedded system into different operating states, provide two command versions (old version and new version), and attach different privileges according to system operating states and command version. According to the current operating status of the system and the privilege of the command, it is determined whether or not to execute the command and whether or not prompt information about the command to be upgraded should be shown to the user. By using the method proposed in this paper embedded software can be a smooth upgrade. The old version command can continue to use, and the progress of the new version command replacing old version command will be a smooth progress.

Authors of the paper “Evaluation on Home Fitness and Community Sports Activities Based on Network Survey” construct the evaluation system of community sports activities by using network survey. The result shows that “community sports service system” is the most important factor in primary indicators; the weight is 0.2906; while “socialization degree of community sports”, “residents’ sports science literacy” and “sports family” are also the important indicators. At the same time, sports features and consumption are the

key factors of home fitness. On this basis, the author puts forward some suggestions on optimizing the evaluation system of community sports activities.

The study “A Novel Analysis System for Urban Construction Information Based on Case-Based Reasoning” proposed a NASUCI (Novel Analysis System for Urban Construction Information). Using data mining technology, case-based reasoning technology, the system focused on providing better decision support for urban construction. The system is composed of user management, enterprise information management, geographical information management, construction information display, construction information management, urban construction information analysis, and comprehensive statistics. NASUCI can help urban planners from a large number of original data mining more effective information, and to provide the chart display, make the analysis of urban construction become more scientific and efficient.

The paper “FPGAs in Manufacturing (Product Inspection System): Presence/Absence Detection” presents a conceptual design for an object presence/absence detection system that will be used in the Manufacturing Industry using a Field Programmable Gate Array (FPGA). They will focus on the development of Automated Visual Inspection tools based on FPGAs.

In the title “Handoff Performance Analysis for Multihoming-based Network Mobility Scheme” proposed a multihoming-based scheme on Proxy MIP6 (PMIPv6) domain for handoff performance analysis relating to handoff delay, packet delivery ratio, as well as throughput at different number of MR, speed and time. After that, it has developed a simulation model to assess the proposed scheme as well as compared it with Network Mobility Basic Support Protocol (NEMO BSP) and multi-interfaced scheme.

May 2016

Carlos Ramos, Instituto Politécnico do Porto, Portugal

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Geotourism as a Strategy of Geosite Empowerment Towards the Tourism Sustainability in Gunungkidul Regency, Indonesia

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Abstract

The enactment of the region of Mount Sewu as a Global Geopark Network (GNN) on 19 September 2015 has given a responsibility for governments and communities to develop this region with a proper concept. The karst of Mount Sewu surrounding the Gunungkidul Regency, Wonogiri Regency and Pacitan Regency is one of the most well-known karst regions in Java Island for its uniqueness. Geoheritage and social-cultural wealth in this region becomes the base of its enactment as GGN. This study presents geotourism as a strategy of geosite empowerment towards the tourism sustainability in Gunungkidul regency. It is found that the Geotourism development comes to be an appropriate strategy in developing 13 geosites in Gunungkidul for fulfilling the directive of the policy on the local and national tourism development, demands of the development trend towards the tourism interest among community and the directive of GGN in accordance with the concept as outlined in UNESCO. The directive of the development of this geotourism has been formulated through a synthesis of various analyses including the analysis of government, analysis of potential tourist attraction, and SWOT analysis. The dialogue from a variety of analyses required to produce the formula of geotourism development of various analyses is needed to guarantee the production of a formulation of the proper and synergic directive for the geotourism development analysis necessary to guarantee the formulation of appropriate and synergic Geotourism development with various existing development guidelines.

Keywords: *Analysis of potential tourist attraction, SWOT Analysis, Geotourism, policy studies*

1. Introduction

The integrated and sustainable tourism development needs to concern with the impact and aspiration of the social custom surrounding the tourism destination. Ideally, all stakeholders directly related to the tourism world are involved in the development planning of a tourism destination region object (locally abbreviated as ODTW/*Objek Daerah TujuanWisata*) and integrally and optimally attempt to develop the potential of tourism by evaluating the profit and benefits for most of people. A well-developed tourism industry will create an opportunity for business, entrepreneurship and wide job opportunity for the locals, even those from outside the region. Directly, given the facilities and infrastructure of tourism in the tourism destination, there will be many labours required by the projects such as the road development to the tourism objects, electricity, fresh water supply, the development of recreational locations, tourism transportation, terminals, airports, hotels, restaurant, travel agents, shopping centres; arts galleries and other amusements. By doing so, there will be an increase of money circle due to the visitation of the domestic or foreign tourists. This then obviously will bring an increase of foreign exchange for state, and national and local income. However, there are some points outside the economic factors deemed necessary to be well considered in the tourism

development such as maintaining the preservation of social culture of the locals, beauty of nature and harmony of the perception of all social components related to the directive of the tourism development.

The issue on the empowerment of living environment and natural resources today is mostly used as a base of the regional development. This is in line with the Law of Spatial Planning No. 26 of 2007 stating that the spatial planning is an effort to manage the distribution of the activities in space giving the geographical expressions towards the economic, social, cultural and ecological policies. To support the achievement of this objective, the capacity and the independence of the society need to be improved and facilitated as regulated in the Law No 23 of 1997 mentioning that society has an equal chance to participate in the management of living environment directed to improve the independence, empowerment and partnership with the society. Gunungkidul Regency in Special District of Yogyakarta is located in the Southern Java Island, Indonesia as shown in Figure 1. This regency has a tropical climate with the area topography dominated by the Karst hills. Some places even have some natural caves and underwater rivers.



Figure 1. Position of Gunungkidul in Java Island in Indonesia

Gunungkidul is located in the spread of Mount Sewu that is spread covering the regency of Gunungkidul, Pacitan and Wonogiri. This region becomes special for having 33 geosites, spread in 33 geosites; 13 of which are located in Gunungkidul Regency in Special District of Yogyakarta; 7 geosites in Wonogiri Regency (Central Java) and 13 geosites in Pacitan (East Java). The karst region of Mount Sewu has been defined as National Geopark since 13 May 2013 – even in 19 September 2015 it was also defined as the Geopark Global Network. To support this, the geopark management in Gunungkidul Regency is well planned in accordance with the direction of the concept of geopark development as regulated by UNESCO. This concept integrates the management of geological *heritages* with *cultural heritages* of a region for three main purposes: conservation, education and sustainable development. Thus, the existence of geopark not only brings a mission of conservation and economy like a park that has various attractions but also must be able to be an educative media and local community empowerment.

One of the ways of the geopark use that can accommodate these roles is by developing it as a tourism attraction object. This is in line with the directive of the development of Gunungkidul Regency in which most of its local incomes are from the tourism sector.

Since the last decade, the tourism sector has been becoming a mainstay sector in Gunungkidul Regency for its significant increase, as shown in Figure 2.

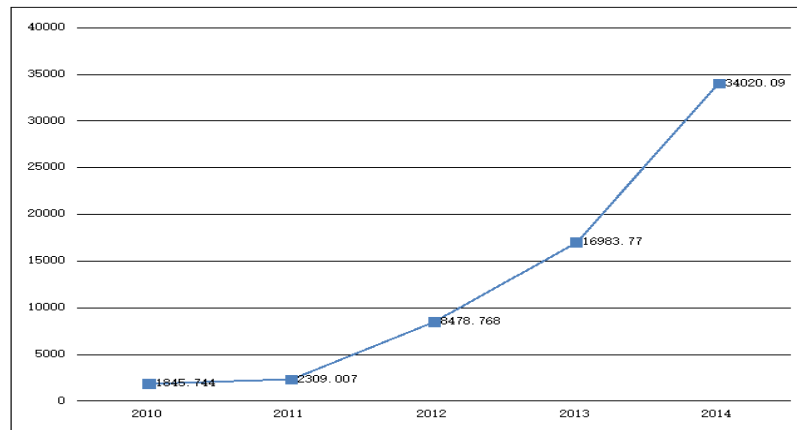


Figure 2. The Increase of Locally-Generated Revenue (LGR) of the Sub-Sector of Tourism in Gunungkidul Regency in the Period of 2010 -2014 (in Million Rupiah)

Source: Book of Tourism Statistics in Special District of Yogyakarta, processed.

UNESCO recommends the concept of Geopark management with the main target of the sustainable use of *geodiversity*, *geoheritage*, and *bio-cultural diversities* for the interest of public and environment surrounding. In line with this, to support the recognition of UNESCO towards the geopark of Mount Sewu – particularly in the area of Gunungkidul Regency, this research is purposely to obtain a formula of geosite development in Gunungkidul Regency. This comes to be important as the issue on the environment sustainability is one of national strategic issues. The urgency of this research includes a number of aspects:

- a. Research urgency in the perspective of environmental aspect:
 - 1) *Geodiversity* and *Geoheritage* as the nonrenewable resource
 - 2) *Geodiversity* and *Geoheritage* have valuable knowledge useful for human and environment surrounding.
 - 3) *Geodiversity* and *Geoheritage* is vulnerable towards any disturbances and highly prone for any anthropogenic activity
 - 4) *Biodiversity* is an environment wealth that has an absolute role towards the environment balance.
- b. Research urgency in the perspective of social-cultural aspect:
 - 1) *Cultural diversities* contains the local wisdom that has a big power in the development
 - 2) The independence of tourism enterprise is a basic capital that is able to support the achievement of development purpose.
- c. Research urgency in the perspective of economic aspect:
 - 1) Database of the potential of *geodiversity*, *geoheritage*, and *bio-cultural diversities* is the basic capital in the tourism enterprise development in Gunungkidul Regency in line with Main Plan of the Tourism Development in Gunungkidul Regency in the period of 2011 to 2025 mandating the local tourism development to be directed to realize Gunungkidul as a natural-based tourism destination with the support of a sustainable culture, competitive to advanced, independent and prosperous society.
 - 2) A previous research showed the existing magnitude of tourism in one side and challenge to enhance the community independence in attempting to improve their welfare.

- 3) The independence of tourism enterprise comes to be an accurate strategy in the program of social prosperity improvement.

The rest of this paper is organized as follow. Section 2 describes material and proposed methodology. Section 3 presents results following by discussion. Section 4 presents conclusion and highlight future works.

2. Materials and Methodology

The keyword in the recommendation of UNESCO towards the management of Geopark is the sustainable utilization. This is supposed to be balanced with a sustainable development, referring to a development to fulfil the today needs without lessening the competency of the future generation to fulfil their needs. The principles of sustainable development include (1) giving guarantee the even distribution and social justice; (2) respect the diversity; (3) Using an integrative approach and (4) Asking the long-term perspective (Djajadiningrat, 2001).

There are two essential concepts in the sustainable development: (1) the concept of needs – an essential need to sustain human life and (2) the concept of limitation coming from the condition of technology and social organization towards the ability of environment to fulfill the today and future needs. To meet those two concepts, it is necessary to fulfil the following requirements (Djajadiningrat, 2001): (1) Ecological sustainability, (2) Economic Sustainability, (3) Social-Cultural Sustainability, (4) Political Sustainability and (5) Sustainability of Defense and Security. In relation to the sustainable tourism development, it needs to concern with how the tourism destination object (ODTW) can be developed without disturbing the existing environmental ecosystem and ignoring the interest of the local community for a better life.

As stated by Mathieson and Wall (1982), tourism is a complex phenomenon that involves a movement of people to one place outside the place they are living in which the activities conducted involves various parties including the activity that uses certain tourism facilities. According to Gartner (1996) as cited by Sudiarta (2011), tourism is also seen in many aspects including physical or environmental aspect. This activity is not apart from the effect emerged particularly the one impacting the social-cultural, economic and physical environment aspects. Tourism has a wider spectrum that is an open system of a number of main elements that have a direct interaction with nature, those are human, tourists, area doing the activity, destination of area and economic-industrial elements (Leiper cited by Gartner, 1996). Entirely, this element is arranged in various functions that interact physically, technologically, socially, culturally, economically and even politically.

Given the enactment of Law No. 32 of 2004 on Regional Government, various efforts for the development of regional potential come to be interesting and even this has been attempted by various parties for the optimal utilization. Many possibilities in all sectors are sought to be developed in a way to contribute to the success in the governance implementation as also occurred in tourism sector. In many cases, tourism comes to be the potential of the focus on the policy orientations to boost the contribution of regional revenue. This then will create the excessive exploitation of the tourism assets in certain areas. In general, there are still many obstacles that cause the tourism management in the area of Gunungkidul Regency not optimal, including:

- a. Low added-value. This is related to the creativity, innovation and lack of competency in interpreting an opportunity. In many considerations in tourism development, sometimes, it is not realized that actually there is a tourism asset that, if well managed, can have a promising added value. However, many today assets or objects that still have a low added-value making them less noticed. This cannot be apart from the lack of creativity, innovation and interpretation of government, actors or even the society itself.

- b. The low involvement of the stakeholders. It is related to the unpreparedness of society and lack of facilities from the related parties. To see whether potency can be a tourism object is always related to the willingness of society to actively and positively participate in development, management and maintenance for it. If one of the elements is not fulfilled, it then can cause the tourism development unbeneficial. Hence, the local community must be given an access or facilitation to be ready to be involved in developing, managing and using the existing objects as active participants – not as the passive ones.
- c. Physical orientation, being lulled for the natural wealth and culture as a power considered as a given. This can make the parties competent in tourism view that the asset merely is as a finding; then implementing a policy that the finding needs to be commercialized simply with beauty covering the object as the only one criterion to determine the prospect of its development and marketing. The success of a tourism potential to be a tourism object or to be commercialized actually needs more requirements both in technical, administrative and local values aspects.
- d. Lack of understanding from a number of stakeholders. Given the existence of various changes, including the change in government, institution and policy as an impact of the local autonomy, culture shock occurs in any levels. If this occurs continually, then it possibly can emerge a disadvantageous dilemma in the tourism development.
- e. Short-term orientation to obtain the profit. Continuity in long-term thought needs to be enhanced in responding the tourism development particularly for non-renewable tourism objects. Sometimes, the short-term interest seems to be more promising but this obviously must consider about its long-term utility.
- f. Lack of togetherness among the tourism actors with other sectors. It is important to note that the complement excellence of a tourism asset is also necessary to be a consideration for the tourism developers that may come from any elements such as government, travel agents, or tour guide. To make tourism better, there is a need to create an equal implementing step in accordance with each competency to prevent any overlap in utilizing the existing tourism asset. Without any togetherness in a tourism development, the outcome in tourism development will not be optimal.

Cited from Holden (2000), Peter Mason (2003) in his writing, it is stated that the environment or physical condition is one of the important factors in tourism. This has been realized in last decade in which the tourism is highly reliant upon the physical condition and environment both as the main attraction of tourism itself and as a place where the tourism activity occurs. The interaction between environment and tourism is complex and symbiotic; both are dependent to each other.

2.1. Mechanism of Tourism Implementation

The authoritative implementation of Local Government related to the local autonomy particularly in tourism sector needs to be supported and stimulates the achievement of local autonomy by improving a mechanism in the main implementation of tourism in terms of the quality of public service that is competence in developing a better, faster and simpler service. In the tourism implementation, based upon the administration of tourism development, the government only acts as a regulator/facilitator and booster. It only runs the function of technical guidance; while the private parties are given a wider authority and supports. The mechanism expected is when the private parties act as the frontline and dominates in the tourism development.

In the tourism implementation, the first measure needed to be done is to understand some issues that will be the base in developing the following tourism. These issues can be in the form of issues, positive impact, negative impact and willingness of a group of societies/entrepreneurs and the development planning as the potential and drawbacks in tourism development. Then, the issues are inventoried and all parties related to tourism

must be in agreement and are able to unanimously answer the issues objectively and logically.

The identification of potential and drawback is conducted to collect the data and information about the potency and drawback as well as a general condition of a region that will be developed as a tourism destination area. The activity of identification of potency and drawback includes the aspects of attraction and uniqueness of nature, ecological/environmental condition, social, cultural and economic condition, region allocation, facilities and infrastructure, potency of market share of ecotourism and funding.

From the result of identification of potency and drawback, furthermore, the analysis of potency and drawbacks is given covering the following points: legality aspect and legal bases, resource potential and nature uniqueness, business analysis, analysis on environmental impact, economic analysis (cost and benefit analysis), social analysis (community participation), and analysis on lay-out.

The development of geosite as geotourism is an accurate strategy in line with the government directive. This is stated in Regulation of Indonesia Republic No.5 of 2011 on the Master Plan of National Tourism Development in the Period of 2010-2025 explicitly stating that one of the tourism potencies that can be developed in Indonesia is the type of natural tourism. Meanwhile, in the Strategic Plan of Directorate of Tourism Destination Development in 2012-2014, it is mentioned the development of one of tourism destinations is the geotourism destination related to the geological formations or sites. In line with this policy, in the Master Plan of Local Tourism Development in Gunungkidul Regency in the period of 2011-2025 it is said that the local tourism development is directed to realize Gunungkidul as the natural-based tourism destination supported by a sustainable culture, competitive to advanced, independent and prosperous society.

As stated in Law No. 10/2009, tourism is a kind of activity supported by any facilities and service provided by society, entrepreneurs, Government and Local Government. Also stated by Surjanto (1985), to fulfil the needs and service, tourism must be supported by any components including (1) Tourism Object and Attraction, also called as tourism attraction in the form of all cultural and natural attraction, and any activities that can attract the tourists to come; (2) Transportation and Infrastructure to support the accessibility in term of the issue on reaching the tourism site and (3) Amenities, covering a number of facilities provided by tourism object. With different ways, as stated by Yoeti (1983), the development of a tourism destination object must fulfil 3 requirements:

- a. The area must have “*something to see*”, meaning that in that area, there must be a different tourism object and tourism attraction different from other places or it must have a specific attraction.
- b. The area must be provided “*something to do*” meaning that in that area, in addition to many things to see; it also must be supported by the recreational facilities making the visitors comfortable to stay longer.
- c. There must be “*something to buy*” in the area, meaning that there are facilities for buying gifts.

In line with the development of local tourism, the geotourism in Gunungkidul Regency that is based on natural potential needs to be developed with a sustainable principle. This principle makes a balance between social purpose, economic purpose and environmental purpose; all of which are directed to how the tourism development can give a long-term profit for society and stimulate the responsibility, ethics and attitude improvement. Based on the explanations above, the geotourism in Gunungkidul Regency is highly suitable to be developed using the Geotourism concept.

Summarizing all policies and directives of the existing development, the geotourism development needs to fulfil the following points:

- a. *Geologically based*. It means that the object/place/location used as a geotourism area is the formation of the geological process.

Based on the geological condition, 13 geosites in Gunungkidul Regency are the natural wealth with the high potential of tourism attraction. As a geological wealth, moreover defined as a Geopark Global Network, this potency must be protected to make the conservation principle will be a strong base in its development. This is in line with the opinion of Hose (1996, 2000) saying that the definition of Geopark can be understood through its essence, function and implementation as the components interacted with nature and life on earth. The tourism attraction in the development of geotourism includes the potentials of *geodiversity*, *geoheritage*, and *bio-cultural diversities* in Geosite in Gunungkidul Regency. Therefore, the concept of Geopark comprises three basic essences:

- 1) As a region that has an essence as a geological inheritance that needs to be preserved as a place to apply the strategy of sustainable economic development conducted through the good and realistic management structure.
 - 2) Geopark implements to give an opportunity for the creation of job vacancy for the local community in terms of gaining the real economic benefits commonly through the sustainable tourism activities.
 - 3) In the frame of geopark, the geological inheritance object and the geological knowledge share with the public. The existing geological elements and natural spread are correlated to the natural and cultural aspect.
- b. Sustainable, the development and the management of geotourism site must be sustainable to maintain its preservation.
 - c. Geologically informative, equipped with the information about the history of the geological formation. Thus, the tourists are able to understand about occurrence of the natural process.
 - d. Locally beneficial, providing benefits for society/community living nearby.
 - e. Tourist satisfaction, providing satisfaction physically and psychologically for the visitors.

The concept of geotourism is a new concept of tourism development in Indonesia. A natural-based tourism development concept previously known is Ecotourism. As stated by Ministry of Tourism and Creative Economy of Indonesia Republic, Ecotourism is a concept of a sustainable tourism development concept aimed to support any efforts of environmental preservation (nature and culture) and to improve the economic benefit for local community and local government. In general ecotourism can be defined as a form of nature-based tourism. Meanwhile, according to Ceballos-Lascurain, ecotourism is a form of travelling in which the natural environment becomes the main focus. However, much more than that, ecotourism, as stated by IUCN (now to be World Conservation Union, 1996), is a travelling and visitation to a natural areas that are mostly untouched before with an aim to enjoy and respect the nature (and any social aspects on it) to encourage other activities; namely natural conservation that has a negative impact on the minimum environment and give a maximum social-economic impact on society nearby. Ecotourism is a sub-component of a sustainable tourism.

Ecotourism and nature-based tourism in common takes the areas in the protected zone, conservation areas, remote areas with exceptional nature beauty, ecological area and cultural heritage area. Citing Chafe (2005, 2007) in the writing of Wearing and Neil (2009), though many conflicts in the interpretation about ecotourism in the tourism industry, one thing to be highlighted is about the increasing awareness and global growth in the ecotourism sector in which this cannot be seen merely as a trend in tourism but this reflects a fundamental change in terms of how people interact with nature. Compared with this concept, geotourism has a higher complexity and wider scope of development as seen in Figure 3.

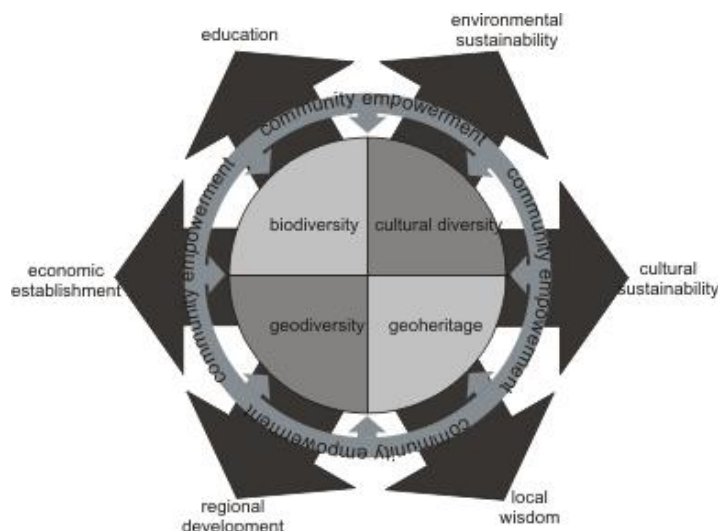


Figure 3. Scope of Tourism Development with the Geotourism Concept

Karst of Mount Sewu covering the region of Gunungkidul, Wonosari and Pacitan is one of the most famous karst areas in Java Island for its uniqueness and typicality. Karst is a landscape commonly characterized with the closed depression, surface drainage and caves. This area is formed particularly by the stone dissolution, mostly limestone. Geologically, Mount Sewu has been formed from the Neogene limestone (Middle Miocene) with the thickness at more than 200 m. Its morphological typicality has made Mount Sewu to be established as *Geopark* (Earth Park) in Indonesia.

Seen from the Plate Tectonic Theory, Indonesia is located in the joint of three big plates. The dynamics of earth crust has caused the geological disaster in the form of volcano eruption, earthquake, tsunami and slide. It also results in geological resource and the emergence of geological phenomena in the form of landscape, structure and any types of abundant stone/mineral and fossils later forming the geosite wealth potential to be developed to be a geopark in Indonesia. Geology has a significant influence towards the civilization and diversity on earth. Since the paradigm shift in the utilization of the geological resources from extractive to conservative, a number of geologists competitively arrange a concept of geological conservation that can be in synergy with the sustainable development without declining the meaning of the protection towards the stone exposure (geosite), landscape (*morfosite*), and all elements contained in it (Permadi, Reza, 2014). The initiative of UNESCO (*United Nation Educational, Scientific and Cultural Organization*) to support the geopark is a response towards the big needs for the international framework as aspirated by a number of countries to enhance the protection of *geoheritage*.

Planning refers to a process of making decision about what thing must be done in future and how to do it. As stated by Kusmayadi (2004), planning must consider with the today state realistically and potential factor that can be developed. Page and Ross (2002) defined the plan as a process with certain purpose that will be targeted, controlling and monitoring any changes that will occur for maintaining the sustainability of the area and for adding the experiences of tourists towards the region or location. In this case, Hall (2000) revealed that if the tourism plan has been suitable/in line with the trend of regional plan, then the tourism is not always seen as the main focus in the planning process. In Gunungkidul regency, there are 13 geosites established as an international geopark. With this wealth, as an initial plan step, it is necessary to do a study on the potency to formulate a development plan suitable with the existing condition and in line with the directive of local and national tourism directives. The tourism plan covers the following aspects (Dimjati, 1999):

- a. Tourist aspect – it is necessary to be analysed for the characteristics of the tourists that are expected to come
- b. Transportation aspect – it is about how the available transportation facility is good either from the home land or the transportation to the tourism object.
- c. *Attraction*/tourism object in term of what is seen, done and bought in the tourism destination area visited.
- d. *Service facilities*.
- e. Information and promotion aspect – it is about the promotion methods to be done through the advertisement and available packet.

3. Results & Discussion

The tourism development needs to be well planned to minimize any impacts that might occur. The impact of tourism according to Prajogo (1976) refers to the tourism indication that can be in the form of conflict or significantly positive or negative impacts. At best, the positive impacts can be duplicated and the negative ones can be prevented. Of the impacts that might occur, it is the physical impact including the environmental impact. The environmental impact can be about the condition that can impact the ecological condition and original habitat of the tourism area. Some of negative impacts of tourism are related to the more increasing number of tourists compared to the capacity of the environment to accommodate the utility or know as *carrying capacity*; as a consequence, there will be a significant pressure towards the nature. According Mason, (2003), the positive impacts can be in the following forms:

- a. Tourism can stimulate the growth of the monitoring and applied steps for the protection of environment and /or landscape and/or wild life
- b. Tourism can help to introduce the existence of the National Park or Conservation area
- c. Tourism can introduce and promote the existence of heritage building and/or area
- d. Tourism can bring a profit as a funding source of a region

On the other hand, a number of negative impacts commonly occurred include (Mason, 2003):

- a. Tourists tend to litter the rubbish and makes the tourism site dirty
- b. Tourism can make people or vehicles more crowded
- c. Tourism contributes to the water pollution and coastal areas.
- d. Tourism can create erosion
- e. Tourism can create some unintended developments
- f. Tourism can create any disturbances and damage on the habitat of wild life

An uncontrolled tourism activity can be a threat to environment. As revealed by UNEP (United Nations Environment Programme), the main impact of tourism on environment is divided into three main points: lack of natural resources, increasing pollution and impact on ecosystem. The tourism activity can create a great pressure for the local resources such as energy, water, forest, soil and wild life. Frequently, forest is negatively affected due to the deforestation and land clearing for parking area or public facilities.

Tourism also can create other impacts such as pollution (air emission, noise, solid waste, liquid waste or visual pollution). Emission from the transportation and energy production can create acid rain and photochemical pollution. At the global level, it will impact on the global warming. The noise pollution can also change the attitude of animals towards the pattern of their natural activities. This indirectly can change the nature and its attitude.

Based on the explanation above, in general, the physical impact of tourism can be divided based upon *area of effect*, including biodiversity, erosion, physical damage, pollution, issues on resources, and changes or visual or structural damages. An interesting tourism area can surely have a landscape together with a variety of ecosystems. However, the development of supporting facilities of tourism such as infrastructure development can

cause soil and mineral degradation. In addition, the infrastructure development also annihilates the population of certain habitat in the area.

Different from other tourisms in which the impact is commonly directly seen and felt, nature-based ecotourism or tourism has an assumption that there will be no physical impact from the development of ecotourism. Coincided with the more increasing number of ecotourism, it cannot be denied that ecotourism will gradually bring an impact on economic, social or cultural dimension as well as on physical impact.

The impact can be in the form of negative or positive impact. As stated by Spillane (1996), the impacts of nature-based tourism are the water and air pollution, traffic density affecting the road condition and natural scenery impairment.

As mentioned in literature of Tourism Management Plan (2009), management of nature-based impact management can be divided into a number of types of control such as natural environment, fostered environment, sociocultural, and socioeconomic. Then, these controlling types are also divided based upon the location.

In Indonesia, the management of living environmental impact has been regulated in Law No.32 of 2009 on the Protection and Management of Living Environment. The analysis on the living environment, also known as Environmental Impact Assessment (IEA), is one of important aspects in making a decision on the development of a region both for industry, education and tourism. Some points studied in the EIA include physical-chemical, social, economic, sociocultural and community health aspects. Meanwhile, the aim of the protection and management of living environment is stated in Article 3 including:

- a. Protecting the territory of United State of Indonesia Republic from any contamination and/or the damage of living environment;
- b. Ensuring the safety, health and human life;
- c. Guaranteeing the life sustainability of living creatures and preservation of ecosystem;
- d. Maintaining the preservation of living environmental functions;
- e. Reaching harmony, alignment, and balance of living environment;
- f. Ensuring the fulfilment of justice for the today and future generation;
- g. Ensuring the fulfilment and protection of rights for living environment as a part of human rights;
- h. Controlling the utility of natural resources wisely;
- i. Realizing a sustainable development and
- j. Anticipating the global environmental issues

The initial step that needs to be done in the implementation of tourism is to observe the issues and identify the potentials of tourism development. The identification of the potential and drawbacks is conducted to collect the data and information that will be developed as a tourism destination area. The activity of the identification of the potentials and drawbacks includes the aspects of attraction and uniqueness of nature, ecological/environmental condition, social, cultural and economic condition and facilities and infrastructure of tourism activity.

Having identified the potentials and the drawbacks, the result of it is then analysed to obtain the priority description of the tourism development and the recommendation or directive of tourism development.

The analysis on the tourism potential is the strategy of the assessment of the potentials of the existing tourism attraction to obtain a description of strengths and weaknesses of any geosites in Gunungkidul Regency for drafting the priority of the tourism development from 13 geosites. In the analysis of the tourism potentials, the assessment given on the components of tourism in each geosite includes: (1) Attraction in the form of all attractions such as from nature, culture, things or activities that can attract the tourists to visit; (2) Amenities covering the facilities provided by the tourism object; and 3)

Accessibilities, an issue to reach the tourism location. Based on the result of the analysis on the potential of tourism, the assessment can be obtained as seen in Table 1 below.

Table 1. Study on the Potency of Tourism Attraction from 13 Geosites in Gunungkidul Regency

N o	Geosite	Component	Sub-Component	Score	Weight	Score
1	Ancient Volcano Nglanggeran	Attraction	Resource	5	20	100
			Tourism activity	5	20	100
			Cleanness of geosite	2	10	20
			Comfort of geosite region	5	10	50
		Accessibility		3	20	60
	Supporting facilities and Infrastructure		8	20	160	
		Total Score		28	100	490
2	Sea Deposit of Beginning Miocene of Sambipitu	Attraction	Resource	2	20	40
			Tourism Activity	0	20	0
			Cleanness of geosite	1	10	10
			Comfort of geosite region	1	10	10
		Accessibility		3	20	60
	Supporting facilities and infrastructure		2	20	40	
		Total Score		9	100	160
3	Pindul Cave	Attraction	Resource	7	20	140
			Tourism activities	5	20	100
			Cleanness of geosite	3	10	30
			Comfort of Geosite region	5	10	50
		Accessibility		3	20	60
	Supporting facilities and infrastructure		9	20	180	
		Total Score		32	100	560
4	Kalisuci Cave	Attraction	Resource	6	20	120
			Tourism activities	5	20	100
			Cleanness of Geosite	2	10	20
			Comfort of Geosite region	4	10	40
		Accessibility		3	20	60
	Supporting facilities and infrastructure		6	20	120	
		Total Score		26	100	460
5	LuwengJomblang	Attraction	Resource	6	20	120
			Tourism activities	5	20	100
			Cleanness of geosite	2	10	20
			Comfort of geosite region	4	10	40
		Accessibility		3	20	60
	Supporting facilities and infrastructure		4	20	80	
		Total Score		24	100	420
6	Siung Beach and Wediombo	Attraction	Resource	6	20	120
			Tourism activities	4	20	80
			Cleanness of geosite	2	10	20

	Beach		Comfort of geosite region	5	10	50
			Accessibility	1	20	20
			Supporting facilities and infrastructure	9	20	180
			Total Score	27	100	470
7	PurbaSaden g Valley	Attraction	Resource	3	20	60
			Tourism activities	3	20	60
			Cleanness of geosite	2	10	20
			Comfort of geosite region	4	10	40
		Accessibility			20	60
		Supporting facilities and infrastructure			20	40
		Total Score		17	100	280
8	Bleberan Waterfall (Sri Gethuk Waterfall)	Attraction	Resource	4	20	80
			Tourism activities	4	20	80
			Cleanness of geosite	2	10	20
			Comfort of geosite region	5	10	50
		Accessibility			20	60
		Supporting facilities and infrastructure			20	180
		Total Score		27	100	470
9	Jlamprong Cave	Attraction	Resource	4	20	80
			Tourism activities	5	20	100
			Cleanness of geosite	2	10	20
			Comfort of geosite region	4	10	40
		Accessibility			20	60
		Supporting facilities and infrastructure			20	60
		Total Score		21	100	360
10	LuwengCok ro	Attraction	Resource	4	20	80
			Tourism activities	5	20	100
			Cleanness of geosite	2	10	20
			Comfort of geosite region	4	10	40
		Accessibility			20	60
		Supporting facilities and infrastructure			20	60
		Total Score		21	100	360
11	Ngingrong Cave	Attraction	Resource	7	20	140
			Tourism activities	6	20	120
			Cleanness of geosite	2	10	20
			Comfort of geosite region	4	10	40
		Accessibility			20	60
		Supporting facilities and infrastructure			20	80
		Total Score			100	460
12	Wanagama Forest	Attraction	Resource	6	20	120
			Tourism activities	5	20	100
			Cleanness of geosite	2	10	20
			Comfort of geosite region	4	10	40
		Accessibility			20	60

		Supporting facilities and infrastructure		20	100
		Total Score		25	440
13	Derivative Forest	Attraction	Resource	5	100
			Tourism activities	5	100
			Cleanness of geosite	2	20
			Comfort of geosite region	4	40
		Accessibility		20	60
		Supporting facilities and infrastructure		20	80
		Total Score		23	400

The abundance of geosite wealth in Gunungkidul regency needs to be responded through the accurate draft of development to make it entirely in line with the development plan of Gunungkidul Regency and in general can be beneficial for the improvement of community prosperity. Based on the assessment of potential of the development above, the priority of the development of the existing 13 geosites can be arranged as listed in Table 2.

Table 2. List of Priority of Geosite Development in Gunungkidul Regency

No	Geosite	Total Score
1	Pindul Cave	560
2	PurbaNglanggeran volcano	490
3	Siung Beach and Wediombo Beach	470
4	Bleberan Waterfall (Sri Gethuk Waterfall)	470
5	Kalisuci Cave	460
6	Ngingrong Cave	460
7	Wanagama Forest	440
8	LuwengJomblang	420
9	Derivative Forest	400
10	Jlamprong Cave	360
11	LuwengCokro	360
12	Ancient valley of Sadeng	280
13	Sea Deposit of beginning Miocene Sambipitu	160

Spatially, the list of priority can be seen in Figure 4.



Figure 4. The Priority of Geosite Development in Gunungkidul Regency

Each of geosites in Gunungkidul Regency has its own uniqueness and high attraction to be developed as a geotourism. Geosite of Pindul Cave, in this case, has some excellences for being greatly supported by community in its potential development making the assessment in the sociocultural aspect so high. Recently, geosite of Pindul Cave has been developed as a tourism object by local community through a number of KelompokSadarWisata (Tourism-Aware Group) developed in Bejiharjo Village, an area in which the Pindul cave is located in. This group independently organizes and develops a tourism offer in the geosite of Pindul Cave and correlate with some other potential nearby. The commitment of community to manage the tourism activity here shows their awareness and concern to the potential of the existing geosite. Even, it proves their concern in the social and economic improvement in this area. This then brings an opportunity for the highly significant tourism development that gives an assurance for the achievement of the development of this potency as a tourism attraction. This condition is in line with the statement of Page and Ross (2002) that the support of the stakeholder plays a significant role in the achievement of the development of tourism attraction of an area.

From the general description about the condition and profile of geosite in Gunungkidul Regency and by considering the external factor (opportunity and threat), the SWOT analysis on the development of geotourism of Pindul Cave is formulated as follows:

a. Strength (S)

- 1) Abundant geosite wealth
- 2) High *geodiversity*
- 3) Variation of potential of other tourism attractions around the geosite of Pindul Cave
- 4) The more increasing number of visitors to geosite of PindulGeosite
- 5) The development of community commitment to manage the geosite of Pindul Cave as the tourism object
- 6) Great support and development of geotourism
- 7) Rapidly developed promotion of geosite of Pindul Cave for tourists

b. Weaknesses (W)

- 1) Low understanding of community about the geopark concept
- 2) The poor effort of geotourism management
- 3) The low coordination in geotourism management among the stakeholders

- 4) Lack of geotourism promotion
- 5) Less developed diversification of tourism in responding *geodiversity*
- c. Opportunity (O)
 - 1) The support of Regulation of Minister of ESDM RI No. 17 of 2012 on the Establishment of Karst Landscape Region
 - 2) The support of Law No.11 of 2010 on Tourism
 - 3) The support of Law No. 26 of 2007 on Spatial Plan
 - 4) The support of Law No. 23 of 2014 on the Local Government of the Chapter of Mining Permit
 - 5) The support of Law No. 11 of 2013 on Cultural Site
 - 6) The support of Local Regulation of Special District of Yogyakarta (DIY) No.1 of 2012 on the Master Plan of Tourism Development in the period of 2012-2015.
 - 7) The support of Local Regulation of DIY No. 62 of 2012 on the Conservation of Cultural Heritage and Cultural Site
 - 8) The support of local regulation of Gunungkidul Regency No. 5 of 2013 on the Tourism Implementation
 - 9) Geopark Region of Mount Sewu listed in Global Geopark Network
 - 10) The increase of tourist interest both as domestic and as foreign tourists
 - 11) Advanced technology
- d. Threat (T)
 - 1) The high interest of community to mine the geosite
 - 2) Lack of monitoring and protection to the areas surrounding the geosite
 - 3) Lack of understanding and awareness of community towards the environment conservation

From the SWOT analysis above, a strategy of geosite development can be formulated as seen in Table 3 below.

Table 3. Strategy of Geosite Development Based Upon SWOT Analysis

Strategy of SO Development	Strategy of ST Development
<ol style="list-style-type: none"> 1. Identifying the geosite condition 2. Documenting and publishing the uniqueness of geosite 3. Formulating the plan of geotourism development in a synergic manner with any potentials of other tourism attraction by maintaining the conservation and sustainability of geosites 4. Formulating a model of geotourism management with community involvement 5. Using the advanced technology in the efforts of geotourism management 	<ol style="list-style-type: none"> 1. Improving the understanding and awareness of community about the importance of environment conservation 2. Formulating the plan of geosite conservation/preservation 3. Formulating the plan of restoration of damaged geosite 4. Formulating the plan of management and development of tourism areas under an integrated management
Strategy of WO Development	Strategy of WT Development
<ol style="list-style-type: none"> 1. Improving the understanding of community about the geopark concept 2. Formulating the plan of geotourism management in accordance with the geopark concept 3. Formulating the model of integration of geotourism management 4. Formulating the plan of promotion and marketing the geotourism 5. Developing the diversification in 	<ol style="list-style-type: none"> 1. Improving the understanding and awareness of community about the importance of environmental preservation 2. Formulating the plan of geosite conservation 3. Developing the diversification in responding <i>geodiversity</i>

- | | |
|---|--|
| responding <i>geodiversity</i>
6. Utilizing the advance of technology in the effort of geotourism management | |
|---|--|

4. Conclusion & Future Works

The high spread of geosites and a number of other non-geosite tourism attraction objects in Gunungkidul Regency become the base of needs for the directive issuance towards the tourism development both in macro and micro scope. The directive of the macro development refers to a directive of tourism development in Gunungkidul regency to ensure the synergy of the tourism development with the development of Gunungkidul regency in general. It also to ensure the implementation of the development of the tourism attraction objects in Gunungkidul regency integrally. The directive of the micro development, meanwhile, is the one of tourism developments in a smaller scope in which later it needs to be detailed to be a more technical directive of development of tourism attraction object.

4.1. Directive of Macro Geotourism Development

Viewed from the potential and the directive of the tourism development by Local Government of Gunungkidul Regency particularly related to the destination of nature tourism, the geotourism area is more appropriate to be developed as the sustainable environment and community culture-based tourism objects in accordance with the geopark concept - a concept of a sustainable tourism development aimed to support any attempts of environmental preservation (nature and culture) and to enhance the community participation in management. By doing so, it can bring a benefit in terms of economic education to the community and local government.

Based on the consideration above, the directive of the macro development of Geotourism is formulated as follows.

- a. **Providing experience and education to tourists** that can broaden the understanding and appreciation towards the tourism destination. The education is given through the understanding about how important the environmental preservation is. This can be done by providing the nature and environment as an original, beautiful and preserved tourism object. The experience is given through the creative tourism activities along with the prima service.
- b. **Minimizing the negative impact on the environmental characteristics and culture** in the area visited. This can be done through the tourism plan that does not damage the environment but still considers the environmental preservation in its attraction development.
- c. **Involving the community in the management and implementation of tourism activities** in some areas of geosite, community has been involved as the active actor in tourism area; hence, the community development in further tourism development is no longer something new.
- d. **Providing economic benefits particularly for local community.** For this, the ecotourism activity must be profitable. The involvement of community as an active manager of tourism activity is an evidence that the tourism development in this village can bring an economic benefit in the real improvement of community prosperity.
- e. **Being survivable and sustainable.** This can be a main concern in the effort of further development of tourism activity and facilities in Gunungkidul Regency

From the directives above, the geotourism development must consider 5 (five) basic principles:

a. **Conservation**

The principle of conservation in ecotourism refers to an activity of ecotourism that does not impact on the damage and contamination of local environment and culture. One of the ways to implement this principle is by utilizing the energy-saving local resources managed by people nearby. It is not only community but also tourists to respect and participate in the natural and cultural conservation in the area visited. Much better, if the revenue from the ecotourism can be used for the preservation activity at the local level. For example, certain percent of the profit is contributed to buy garbage cans and pay someone managing the waste.

b. **Education**

The tourism activity should provide an educational element. This can be done through a number of ways including by providing interesting information such as the name and the advantage of plants and animals living around the tourism area, leaves used for medicine or in daily life or the trust and custom of local community. The educational activity for the tourists will encourage the effort of natural or cultural conservation. This activity can be supported by some tools such as brochure, leaflet, and booklet or information board.

c. **Tourism**

Tourism is an activity containing the recreational elements with various motivations of tourists to visit a location. Ecotourism also must contain this element. Therefore, the product and tourism service located nearby must provide an enjoyable element to be marketable and acceptable in market.

d. **Economy**

Ecotourism also provides an economic opportunity for the community and even a number of the tourism travels can use some local resources such as transportation, accommodation and guide service. The ecotourism implemented must provide revenues and profit to survive. To realize it, the most important thing is by providing the best and qualified service and product of tourism. To do so, it will be better if the revenue from tourism is not only used for the conservation program but also to help to broaden the knowledge of local community such as the development of competency through the training to improving the types of business/attraction presented at village level.

e. **Participation of Local Community**

Participation of community might appear when the nature/culture has given a direct benefit for the community. To do so, they need to be managed and maintained. This is a mutual relation between tourism attraction and management of benefits obtained from ecotourism and participation. The community participation plays an essential role for the success of ecotourism in a tourism destination area. This can be started from awareness by not expecting too much that government will do anything as the community also have an equal role in doing the development in their area. Participation in tourism activity will bring a direct benefit for community both from natural preservation and from economic sector. If the nature is kept preserved and clean, the natural preservation could be enjoyed well. Being participated in the tourism activity can also bring some benefits economically.

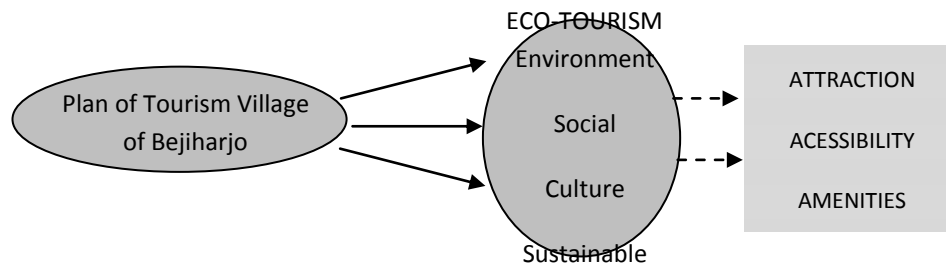


Figure 5. Macro Concept of Geotourism Development

The directive above becomes a consideration in formulating the concept of geotourism development in accordance with the geopark concept. Based on this concept, the geotourism development must include the physical environment, social and cultural aspects as seen in Figure 5.

Environment and Sociocultural-Based Tourism is a tourism activity conducted in the natural places and brings a contribution to the natural preservation and the improvement of local community welfare. The development of this concept directly gives an access to all people to see, know and enjoy the natural, intellectual and local cultural experience for more focused on three main things:

- a. The natural or ecological sustainability
- b. Providing economic benefit
- c. Acceptable in social life of community

4.2. The Directives of the Micro Development of Geotourism

In addition to the macro concept, the geosite management a tourism destination must also be implemented in terms of attraction, accessibility and amenities as seen in Figure 6.

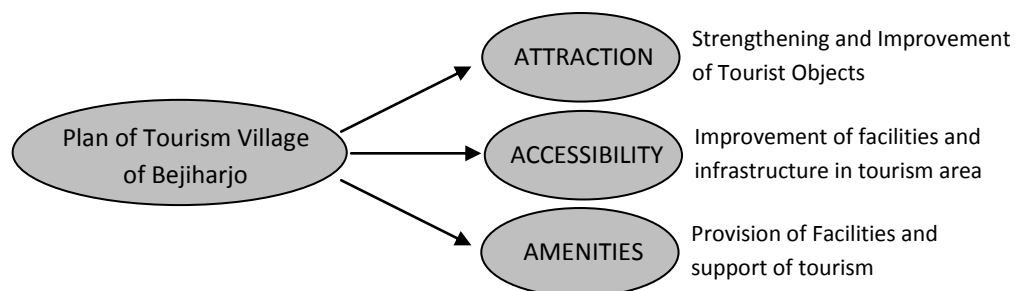


Figure 6. Macro Concept of Geotourism Development

- a. Concept of the Development of Geotourism Attraction
The development of the tourism attraction in the area of geosite needs to be prioritized on the attraction related to the environment and integrated with any potentials of the tourism attraction surrounding. Thus, the development of the attraction is planned in macro and can be managed in the form of tourism package. With this concept, it is expected that the potential of the tourism attraction can improve the economic level of the area using the cross-subsidy.
- b. Concept of the Development of Geotourism Accessibility
The development of tourism accessibility needs to consider the directive of the development of macro accessibility in the region of Gunungkidul in common. The

access in the area of geosite is also necessary to be developed integrally and linked with other tourism objects.

c. The Concept of Geotourism Amenities Development

Amenities or supporting facilities of tourism in the area of geosite are developed by providing a very wide opportunity for the improvement of social prosperity in general.

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