

ANALYSIS OF DECISION MAKING PROBLEM MODELS IN SUSTAINABLE TOURISM DEVELOPMENT PLANS USING CAUSAL LOOP DIAGRAMS AND VENSIM APPLICATIONS

¹Husain,^{2*}Muhammad Zarlis,³Herman Mawengkang,⁴Syahril Efendi

¹Graduate School of Computer Science, Universitas Sumatera Utara,
Medan, Indonesia,

Husain@students.usu.ac.id

²Faculty of Computer Science and Information Tchnology,
Universitas Sumatera Utara,

Medan, Indonesia

m.zarlis@usu.ac.id

³Department of Mathematics, Universitas Sumatera Utara,
Medan, Indonesia

herman.m@usu.ac.id

⁴Faculty of Computer Science and Information Tchnology, Universitas Sumatera Utara,
Medan, Indonesia

syahril1@usu.ac.id

Abstract: The development of sustainable tourism is dynamic, of course it has many factors involved, so the system is complex, where each factor involved has a different purpose and management. This can lead to overlapping and even conflicts between stakeholders. Associated with the dynamic and complex challenges in the development of sustainable tourism, the ability to identify is very necessary. Therefore, this research was carried out in an effort to look more deeply into what things affect the sustainable tourism development plan and what strategies need to be optimized in the development of sustainable tourism. In need of a dynamic causal relationship analysis model of these factors using a systems approach method with a Causal Loop Diagram. (CLD) Model and generate a new multi-criteria decision analysis (MCDA) dynamic computational model that can represent conditions in terms of tourist arrivals, economic improvement and the environment that illustrates the interrelationship of interacting factors This model will look at the factors that influence the causes and effects of all the factors involved and are described in the form of a causal loop diagram that includes economic, social and environmental aspects. This model is used as consideration and decision making for sustainable tourism development planning

Keywords: Model Dinamic, Vensim, Causal Loop Model Diagram, Smart sharia tourism, sustainable tourism

1. INTRODUCTION

Sustainable tourism or sustainable tourism is the development of tourism activities that have a negative impact and can blend with the environment. Tourism development is carried out in a sustainable process, so that tourism can have a positive impact on stakeholders in the tourism sector, without damaging the environment. Sustainable tourism is the concept of visiting a place

as a tourist and trying to make a positive impact on the environment, society and the economy [1]. Tourism can include primary transportation to public locations, local transportation, accommodation, entertainment, recreation, food, and shopping [2]. Tourism can be associated with travel for leisure, business, and what is called VFR (visiting friends and relatives). There is now a broad consensus that tourism development must be sustainable; however, the question of how to achieve this remains an object of debate. Sustainable tourism is the concept of visiting a place as a tourist and trying to make a positive impact on the environment, social and economy [3]. Tourism can include primary transportation to public locations, local transportation, accommodation, entertainment, recreation, food, and shopping [2]. Tourism can be associated with travel for leisure, business, and what is called VFR (visiting friends and relatives) [4]. There is now a broad consensus that tourism development must be sustainable; however, the question of how to achieve this remains an object of debate. The development of sustainable tourism is dynamic, many factors are involved so that it can lead to conflict between stakeholders [5]. Therefore, this study discusses further related to policy by using the Dynamic System Model tool. Several studies that have been conducted provide information that the implementation of public policies can improve the operational thinking skills needed to design a policy model structure for the public sector with a dynamic system [5] [6] [7]. All stages of the public policy-making process can apply a dynamic system to overcome the difficulties of environmental factors that are close to the public policy-making process [8]. So that in an effort to look more deeply at what influences the sustainable tourism development plan and what strategies need to be optimized in the development of sustainable tourism [9]. In need of a dynamic model by analyzing the dynamic causal relationship of the factors involved using the systems approach method with Causal Loop Diagram (CLD). A new multi-criteria decision analysis (MCDA) dynamic model that can affect conditions in terms of increasing tourist visits, by paying attention to economic, social and environmental aspects that describe the interrelation of interacting factors. This model will look at the factors that influence the causes and effects of all the factors involved and are described in the form of a causal loop diagram. This model is used as consideration and decision making for sustainable tourism development planning for sharia tourism.

2. METODOLOGI

The Causal Loop Diagram (CLD) Model Uses An Approach In Problem Solving By Seeing The Complexity Of The System Which Is Described By A Diagram In The Form Of A Curved Line That Ends With An Arrow That Connects One Factor With Another Factor. On each arrow in the Causal Loop Diagram (CLD) there are "S" and "O" signs. The "S" and "O" signs show the relationship between one factor and another. The "S" sign indicates a mutually reinforcing relationship, namely that if the factor causing or influencing factors increases, then the effect factor or the affected factor will also increase. The following are examples of mutually reinforcing relationships [10] [11].

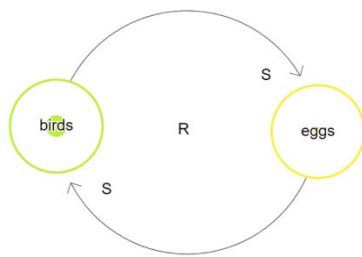


Figure 1 Example Causal Loop Diagram

3. SOME DEFINITIONS

Tourism is a recreational travel activity. In general, the definition of tourism is an activity carried out or a person's travel activities temporarily from one area to another or from one tourist place to another with the aim of finding the place he visited, but solely to enjoy tourism. or recreation to fulfill various desires[12].

Nowadays, in many countries, the tourism sector is used as a foreign exchange earner and a source of tax and state income [13].

a. Sustainable Tourism

Sustainable tourism is tourism that is growing very rapidly, including the increase in the flow of accommodation capacity, local populations and the environment, where tourism developments and new investments in the tourism sector should not have a bad impact and can be integrated with the environment, if we maximize the impact that is generated [14]. Positive and minimize negative impacts. So several initiatives were taken by the public sector to regulate tourism growth for the better and put the issue of sustainable tourism as a priority because a good business or business can protect important resources or assets for tourism not only for now but in the future [15].

b. Principles of Sustainable Tourism Pariwisata

Sustainable tourism development is essentially related to efforts to ensure that the natural, social and cultural resources used for tourism development in this generation can be enjoyed for generations to come. Tourism development must be based on sustainability criteria, which means that development can be ecologically supported in the long term as well as economically viable, ethically and socially fair to the community [14].

c. Dynamic models

The purpose of the Dynamic Model is to build the causal relationship required in the policy formulation process, and also includes all the main causality effect relationship entities. Therefore, this dynamic system is also a tool to support every practical decision that makes it possible to test the effectiveness of various policy scenarios [16].

d. Dynamic System

Dynamic Systems is a methodology and mathematical modeling technique for framing, understanding, and discussing complex problems System Dynamics Model as Mathematical Model The model is an abstraction from the real world that is simplified so that only the important parameters and variables appear in its form [17]. A model can reflect or abstract from an object, process, situation or system. One method of systems approach model is to use a

mathematical model [18]. More broadly a model can reveal and explain the relationship of various components, actions and reactions and causal relationships [19]. The models used in problem solving can be illustrated in the form of diagrams, figures, matrix tables, and other forms such as causal loop diagrams, which are models that emphasize the consideration of the dynamic complexity of the system. This model describes the causal relationship between the variables concerned in the form of a curved line to connect which are the causal variables and which are the effect variables [20].

4. DISCUSSION

4.1.Causal Loop Diagram

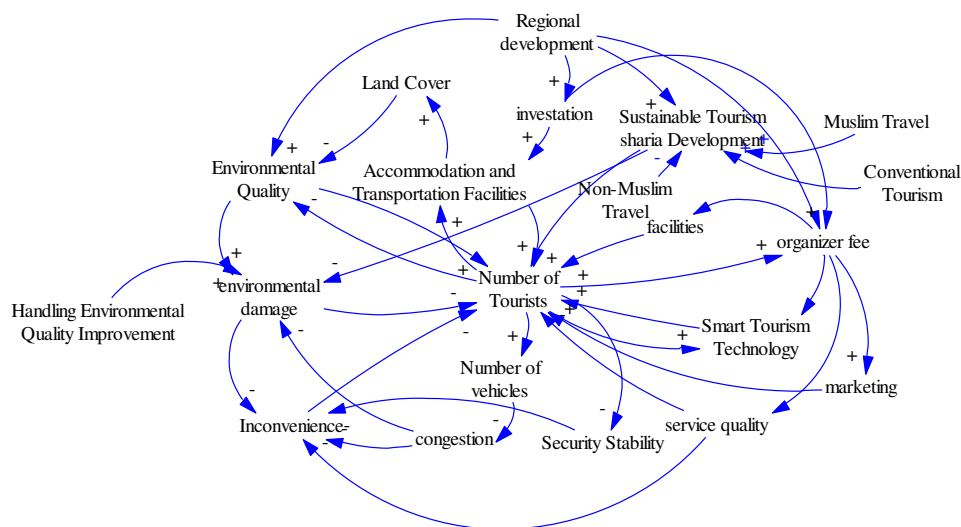


Figure 2 Causal Loop Diagram Development of Sharia Smart Tourism sustainable tourism

In the development of sustainable tourism, it can be seen in the CLD that there are many interrelated factors and show cause and effect. The following describes the causes and effects that occur in the causal loop diagram. In the development of sustainable tourism, it will have a positive effect on increasing the number of tourist visits to destinations so that good service quality and marketing. Marketing will increase if support for organizing costs is increased and will also affect the addition of tourism technology at tourist sites. With the increase in operating costs, of course, it is obtained from regional development funds originating from regional income. Regional income will increase of course if the number of visits to tourist destinations increases, so that there is a positive influence on incoming investment. In sustainable tourism, of course, includes how to maintain the environment so that it is maintained, the economy increases and social conditions are maintained. This means that with an increase in tourists, it will increase economic income, especially for the community around the destination, many hotels will recruit local residents to work and can create businesses such as small and medium businesses, micro businesses, etc. With the existence of sustainable tourism, it is hoped that the increase in tourist

visits will increase so that there will be an increase in the economy both locally in regional income and the income of the surrounding community. However, the occurrence of land clearing and increased congestion will adversely affect the quality of the environment so that it needs to be a concern in the development of sustainable tourism to minimize environmental damage.

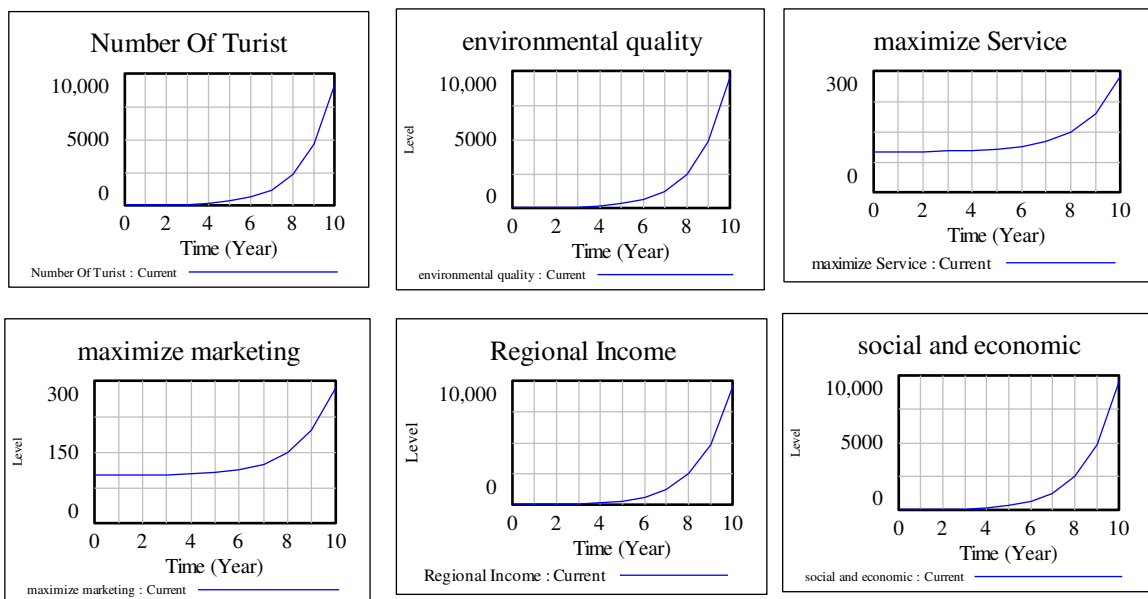
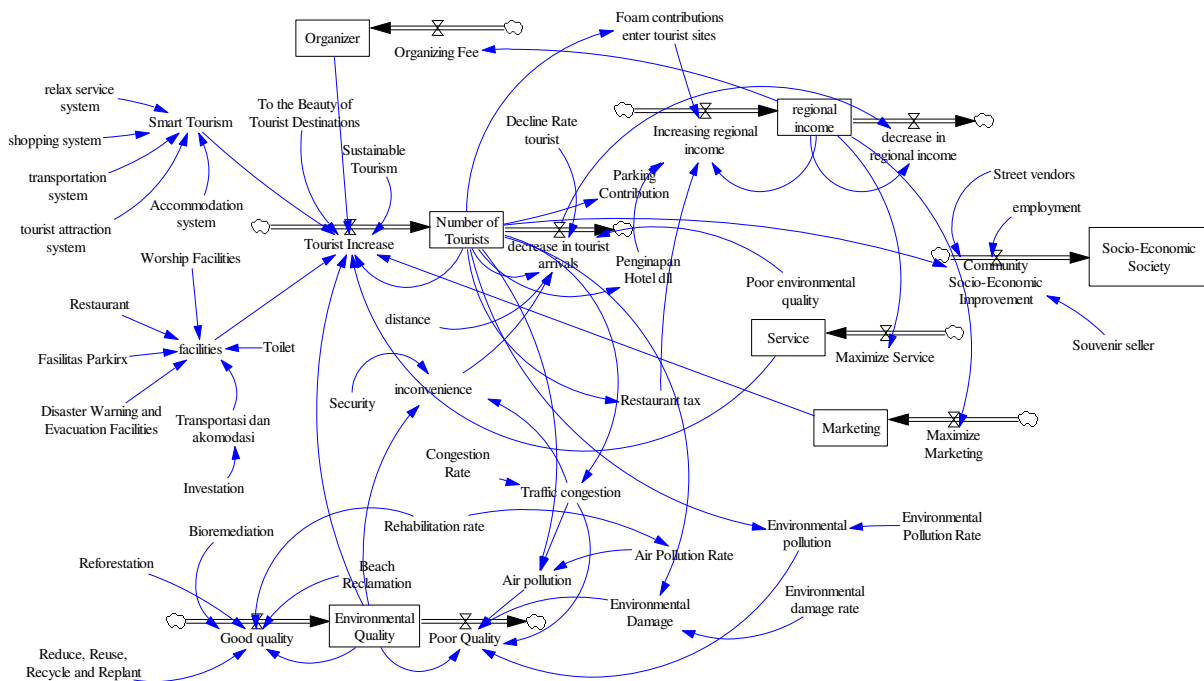


Figure 3 described again in the table bent to explain the cause and effect of the factors involved in developing sustainable tourism Smart Syariah Tourism.

a. Maximize service

Good service quality will certainly increase tourist visits. In the Vensim simulation shown in the graph, it can be seen that the increase in tourist visits is to fulfill customer desires. In other words, there are 2 main aspects that affect the quality of service, namely the expected service and the service felt by the customer is very impressive.

b. Maximize Marketing

increasing tourist visits of course with good marketing. With the marketing strategy implemented, tourists want to know what new tourist destinations are trending and famous. Not only that, with the right marketing strategy so that the tourist attractions that are promoted will grow better and be more crowded by visitors. This strategy helps tourists to identify detailed data about a tourist place.

c. Local Revenue

Regional Original Income will increase if the number of tourist visits increases so that it can support development funding for improving the quality of tourist sites as shown in the graph in Figure 3. seen in the venim simulation. Lodging tax, restaurant tax, restaurant, parking, entry to tourist destinations

d. Organizer

The implementation and development of sustainable tourism must of course take into account the costs of the organizers and as much as possible the activities must be carried out at the minimum possible cost. In this case, it can be simulated with vensim as shown in Figure 3, there are factors that become a source of funds for the development of sharia tourism such as preparation costs, operational costs, infrastructure development costs and others.

e. Environmental quality

Environmental quality is also a very important factor in increasing the number of tourist visits. Increasing tourist visits and opening new land will certainly result in environmental damage. so that an action is needed so that environmental damage can overcome environmental distress as shown in the environmental quality chart in Figure 3.

f. Social and economic community

Seen with the development of sustainable tourism, the social and economic graph of the community will certainly increase which shows the benefits shown such as reducing unemployment, being able to sell in tourist destinations, etc.

5. CONCLUSION

The development of sustainable sharia tourism is a complex and dynamic system. There are many components that interact and influence each other. In the development of sustainable tourism, there are many factors that influence each other and have different interests. In the development of sustainable tourism, of course, the main goal is to increase tourist visits so that the influencing factors must of course be optimized such as maximizing service, maximizing marketing, implementing smart technology, etc. so that the value of visits increases will affect the positive social and economic influence around tourist destinations and environmental damage can

be overcome. Simulate the target of increasing tourists by optimizing the factors that affect the increase in the number of tourist visits and can also optimize the factors that can affect the decrease in tourists. This model is used as the basis for building a computational model that can be used to develop and test alternative management policies in the development of sustainable Islamic tourism.

ACKNOWLEDGEMENTS

My big gratitude to the Faculty Of Computer Science, Universitas Sumatera Utara and to promotor of my dissertation Prof. Dr. Muhammad Zarlis, Co-promotor 1 Prof. Dr. Herman Mawengkang, Co-promotor 2 Dr. Syahril Efend,S.Si M,IT for all guidance and support given to me during all process of my dissertaton.

REFERENCES

- [1] L. Puczko and T. Ratz, "Tourist and resident perceptions of the physical impacts of tourism at Lake Balaton, Hungary: Issues for sustainable tourism management," *J. Sustain. Tour.*, vol. 8, no. 6, pp. 458–478, 2000.
- [2] N. Leiper, "The framework of tourism. Towards a definition of tourism, tourist, and the tourist industry," *Ann. Tour. Res.*, vol. 6, no. 4, pp. 390–407, 1979.
- [3] T. Van Mai, "Systems Thinking Approach As A Unique Tool For Sustainable Tourism Development: A Case Study In The Cat Ba Biosphere Reserve Of Vietnam," *Proc. 54th Annu. Meet. ISSS-2010, Waterloo, Canada. Vol. 54. No. 1.*, 2010.
- [4] E. Backer, F. Leisch, and S. Dolnicar, "Visiting friends or relatives?," *Tour. Manag.*, vol. 60, pp. 56–64, 2017.
- [5] V. H. Van, "Linking Cultural Heritage with Cultural Tourism Development: A Way to Develop Tourism Sustainably," 2020.
- [6] P. Feng *et al.*, "Dynamic wheat yield forecasts are improved by a hybrid approach using a biophysical model and machine learning technique," *Agric. For. Meteorol.*, vol. 285, p. 107922, 2020.
- [7] A. Anggrawan, "Interaction Between Learning Preferences And Methods In Face-To-Face And Online Learning," *ICIC Express Lett.*, vol. 15, no. 4, pp. 319–326, 2021.
- [8] N. Ghaffarzagdegan, J. Lyneis, and G. P. Richardson, "How small system dynamics models can help the public policy process," *Syst. Dyn. Rev.*, vol. 27, no. 1, pp. 22–44, 2011.
- [9] Y. Maruccia, G. Solazzo, P. Del Vecchio, and G. Passiante, "Evidence from Network Analysis application to Innovation Systems and Quintuple Helix," *Technol. Forecast. Soc. Change*, vol. 161, p. 120306, 2020.
- [10] H. V Haraldsson, *Introduction to system thinking and causal loop diagrams*. Department of chemical engineering, Lund University, 2004.
- [11] G. P. Richardson, "Problems with causal-loop diagrams," vol. 2, no. 2, pp. 158–170, 1986.

- [12] R. Yang, "Design of an information system for smart scenic spots," *Proc. - 2016 Int. Conf. Smart Grid Electr. Autom. ICSGEA 2016*, pp. 328–331, 2016.
- [13] Husain, M. Zarlis, H. Mawengkang, and S. Efendi, "Causal Loop Diagram (CLD) Model In Planning A Sustainable Smart Sharia Tourism," *J. Phys. Conf. Ser.*, vol. 1641, no. Cld, p. 012099, 2020.
- [14] Z. Liu, "Sustainable tourism development: A critique," *J. Sustain. Tour.*, vol. 11, no. 6, pp. 459–475, 2003.
- [15] F. Neto, "A new approach to sustainable tourism development: Moving beyond environmental protection," in *Natural resources forum*, 2003, vol. 27, no. 3, pp. 212–222.
- [16] D. J. Peuquet, "It's about time: A conceptual framework for the representation of temporal dynamics in geographic information systems," *Ann. Assoc. Am. Geogr.*, vol. 84, no. 3, pp. 441–461, 1994.
- [17] A. T. Azar, "System dynamics as a useful technique for complex systems," *Int. J. Ind. Syst. Eng.*, vol. 10, no. 4, pp. 377–410, 2012.
- [18] G. C. Gallopín, "Environmental and sustainability indicators and the concept of situational indicators. A systems approach," *Environ. Model. Assess.*, vol. 1, no. 3, pp. 101–117, 1996.
- [19] M. J. Epstein and M.-J. Roy, "Sustainability in action: Identifying and measuring the key performance drivers," *Long Range Plann.*, vol. 34, no. 5, pp. 585–604, 2001.
- [20] L. S. Liebovitch, P. T. Coleman, and J. Fisher, "Approaches to understanding sustainable peace: qualitative causal loop diagrams and quantitative mathematical models," *Am. Behav. Sci.*, vol. 64, no. 2, pp. 123–144, 2020.