Vol. 3 No. 1 Edisi Januari 2026 E. ISSN. 3032-2472
Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

FACTORS INFLUENCING GREEN ECONOMY DEVELOPMENT IN LAKE TOBA TOURISM AREA

FAKTOR-FAKTOR YANG MEMPENGARUHI PERKEMBANGAN EKONOMI HIJAU DI KAWASAN WISATA DANAU TOBA

Zulkarnain Nasution[1*], Aziddin Harahap[2]

[1*]Labuhanbatu University, Email: zulkarnainnasution1974@gmail.com
[2]Labuhanbatu University, Email: aziddinulb@gmail.com

*email koresponden: zulkarnainnasution1974@gmail.com

DOI: https://doi.org/10.62567/micjo.v3i1.1490

Abstract

The development of a green economy is a strategic issue in realizing sustainable development, especially in potential areas such as Lake Toba. However, the role of socio-cultural factors in supporting the green economy has not been extensively researched empirically. This study aims to analyze the influence of Community Awareness, Environmental Knowledge, and Local Cultural Beauty on Green Economic Development in the Lake Toba area. The method used is a quantitative approach with multiple linear regression analysis techniques with the help of SPSS software version 25. Data were obtained from questionnaires distributed to local respondents The results of the study showed that Community Awareness and Environmental Knowledge did not have a significant effect on the green economy, while the Beauty of Local Culture had a significant effect. The value of the determination coefficient (R^2) of 0.4053 indicates that the three variables explain the 40.5% variation in the development of the green economy. These findings confirm the importance of a cultural approach in supporting the sustainability of the Lake Toba region.

Keywords : Green Economy, Community Awareness, Environmental Knowledge, Local Culture.

Abstrak

Pengembangan ekonomi hijau merupakan isu strategis dalam mewujudkan pembangunan berkelanjutan, terutama di wilayah potensial seperti Danau Toba. Namun, peran faktor sosial budaya dalam mendukung ekonomi hijau belum banyak diteliti secara empiris. Penelitian ini bertujuan untuk menganalisis pengaruh Kesadaran Masyarakat, Pengetahuan Lingkungan, dan Keindahan Budaya Lokal terhadap Pengembangan Ekonomi Hijau di kawasan Danau Toba. Metode yang digunakan adalah pendekatan kuantitatif dengan teknik analisis regresi linier berganda menggunakan bantuan perangkat lunak SPSS versi 25. Data diperoleh melalui kuesioner yang dibagikan kepada responden lokal. Hasil penelitian menunjukkan bahwa Kesadaran Masyarakat dan Pengetahuan Lingkungan tidak berpengaruh signifikan terhadap ekonomi hijau, sedangkan Keindahan Budaya Lokal berpengaruh signifikan. Nilai koefisien determinasi (R^2) sebesar 0,4053 menunjukkan bahwa ketiga variabel tersebut menjelaskan 40,5% variasi dalam pengembangan ekonomi hijau. Temuan ini menegaskan pentingnya pendekatan budaya dalam mendukung keberlanjutan kawasan Danau Toba.

Kata Kunci : Ekonomi Hijau, Kesadaran Masyarakat, Pengetahuan Lingkungan, Budaya Lokal.

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

1. INTRODUCTION

Lake Toba, as a strategic area for national tourism, not only holds ecological wealth, but is also closely related to local wisdom and cultural values of the Toba Batak culture, which emphasizes harmony between humans and nature (Lumbanbatu, 2025). However, the acceleration of development that focuses on economic growth and the tourism sector in this region has the potential to threaten the balance of the environment and the preservation of local culture (Mandaasari, 2019). Therefore, the green economy approach becomes relevant to be implemented (Khoshnava et al., 2019)

The implementation of a green economy is often technocratic and fails to fully consider the socio-cultural dimensions of local communities (Noviantika, 2023). Yet, culture is an integral part of that longing. According to UNESCO (2022), culture is the fourth pillar of sustainable development, alongside economic, social, and environmental (Mihaela Clincu, 2024). Culture must not only be preserved but also empowered as a transformative force that can shape the direction of development policies, including in the context of a green economy (Qi, 2024). The following table shows the number of international tourist visits to Lake Toba:

Tabel 1. Number of Tourists Coming by Month and Type of Tourists in 2024

Bulanan	Asing	Nusantara	Total
Januari	27	198.311	198.338
Februari	152	62.237	62.389
Maret	177	114.372	114.549
April	1	135.579	135.580
Mei	0	48.584	48.584
Juni	0	47.319	47.319
Juli	1	47.488	47.489
Agustus	2	23.423	23.425
September	11	32.025	32.036
Oktober	2	28.683	28.685
November	5	24.240	24.245
Desember	1	88.667	88.668
Jumlah	379	850.928	851.307

Sumber Data : BPS Kabupaten Toba (2024)

Green economy-based tourism development in lake areas, such as Banyu Langit, emphasizes the application of the 3R concept (Reduce, Reuse, Recycle) and empowering local communities through culinary and agricultural businesses. Studies in Asia and Europe show that investment in cultural industries can drive green economic growth, especially if directed towards supporting environmental and resource efficiency goals (Hoang, 2021; Elyasi and Yamacli, 2023). This approach not only improves the local economy but also maintains environmental sustainability and strengthens local cultural identity. In other lake areas, preserving natural and cultural heritage is key to attracting tourists and supporting sustainable development (Novita et al., 2024).

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Assessments of sustainable development in cities surrounding lakes, such as those conducted at Dianchi Lake and several other lakes in India, use indicators such as the green-to-blue area ratio, urbanization rates, and land-use change. Studies show that population growth and economic scale are key drivers of improvements in the green development index, but urban expansion at the expense of wetlands and agriculture poses a major challenge. Proper management, including limiting the rate of development of built-up areas around lakes, is crucial for maintaining ecological and economic balance. Culture plays a crucial role in supporting the green economy, both through creative industries and the preservation of cultural heritage. Studies in Asia and Europe indicate that spending on cultural industries needs to be aligned with environmental goals, and that trade in cultural products can improve the green economy index. Furthermore, promoting cultural exchange and cross-cultural innovation can strengthen the synergy between green growth and cultural development.

As a concrete step to measure the implementation of green economy principles, various countries have used the Global Green Economy Index (GGEI). This index assesses a country's performance based on aspects of green policy leadership, investment, resource efficiency, and environmental protection. However, the GGEI does not yet consider cultural factors as determinants of green policy success. Therefore, in the context of Lake Toba, it is necessary to adapt the GGEI by adding a local cultural dimension, making the index more contextual and applicable to regions with socio-cultural complexity such as the Batak community. This approach aligns with the theories of locality and local wisdom proposed by Geertz (1983) and Duxbury and Gillette (2020), which emphasize the importance of local values and traditional practices in building sustainable systems. The Batak community, for example, has a philosophy of life, Dalihan Na Tolu, which regulates the relationship between humans and each other, ancestors, and nature. These values reflect a form of social and ecological harmony that substantially supports green economy principles when interpreted and implemented in development policies

Furthermore, the social ecology approach developed by Fritjof Capra (2020) emphasizes tha t social and ecological systems are inseparable; they are interconnected and form a complex web of life. Within this framework, culture is not understood simply as a social product, but as a living system, interconnected with nature and the social structures of society. Therefore, development in Lake Toba cannot rely solely on technical or economic approaches, but must view culture as a bond between humans and their environment.

Referring to these theories, it is clear that sustainability in the Lake Toba region can only be achieved through an integrative approach, namely by synergistically combining a green economy and cultural development. This study aims to develop a green economy framework based on local culture, capable of capturing the complexity and uniqueness of the Lake Toba region and providing a basis for more inclusive, contextual, and sustainable development policies.

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

2. RESEARCH METHOD

This study uses a descriptive quantitative approach to illustrate the research results in a realistic manner. Primary data were collected through a survey using an interview-based questionnaire, which allows for data collection from selected locations. The questionnaire used a 4-point Likert scale without a neutral option to obtain more definitive and accurate answers Aziz et al. (2023).

The study population included all 851,307 tourists visiting Lake Toba in 2024 (BPS Toba Regency, 2024). The sample was selected using the Non-Probability Sampling method with Purposive Sampling technique, which is a sample selection technique based on certain criteria relevant to the research objectives (R. Wijaya & Nugroho, 2022). The respondent criteria used were tourists aged at least 17 years. Based on the Slovin formula with a margin of error of 10%, 100 respondents were obtained as a sample with the following calculation:

$$n = \frac{N}{1+Ne^2} \quad (1)$$

$$n = \frac{851.307}{1+[851.307\times(0,1)^2} \quad (2)$$

$$n = \frac{851.307}{1+8.513,07} \quad (3)$$

$$n = \frac{851.307}{8.514,07} \quad (4)$$

$$n = 99,99 \quad (5)$$

This study measures three independent variables, namely Public Awareness (X1), Environmental Knowledge (X2), and Local Cultural Beauty (X3) as well as one dependent variable, namely Green Economic Development (Y). The relationship between variables is analyzed by multiple linear regression using the equation:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \quad (6)$$

Prior to this, validity and reliability tests were conducted to ensure data quality, with validity using Pearson correlation (α = 0.05) and reliability using Cronbach's Alpha (>0.60). After the instrument was declared valid and reliable, classical assumption tests were conducted, including normality tests (Kolmogorov-Smirnov), multicollinearity tests (tolerance and VIF), Data analysis included T-tests, F-tests, and coefficient of determination tests (Adjusted R Square) to evaluate the influence of independent variables partially or simultaneously on the dependent variable.

3. RESULT AND DISCUSSION

Sumber : visit samosir.com

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Lake Toba is a lake formed from an ancient volcanic eruption, this lake is actually a giant caldera with a length of more than 100 km, you can imagine how big the Toba volcano was before it erupted and how powerful the eruption of this mountain was. Lake Toba is the largest lake in Indonesia and in Southeast Asia, in the middle of it there is an island called Samosir Island, Lake Toba and Samosir Island have many tourist attractions both natural and cultural beauty. Lake Toba and Samosir Island are located at coordinates: Latitude Longitude: 2.6273112,98.7922018, DMS: 2 ° 37 '38.320"N | 98 ° 47' 31.926"E, UTM: Easting 476901.3556171204, Northing: 290400.79113456415, Zone: 47 N.

Lake Toba is a water resource with significant ecological, hydrological, and economic value. This relates to its role as a habitat for various aquatic organisms, a source of drinking water for the surrounding community, a source of water for agriculture and fisheries, and to support various industries, such as the water needs of the Singapore and Asahan power plants.

Based on the research results, it is explained that the questionnaires distributed to 100 respondents aged 18-55 years in Balige City, North Sumatra Province (data attached)

Chi-Square Test

Based on data processing using SPSS 25.0, the Chi-Square test results were obtained.

Table 2 Uji Chi Square

	Observed N	Expected N	Residual
Public Awareness	99	207	.01
Environmental Knowledge	99	222	.01
The Beauty Of Local Culture	99	224	.01
Total	297	224	.01

Source: Processed Data, 2025

The development variance frequency displays two types of frequencies: the number of green economic development events that occurred (Observed N) and the number of expected green economic development events (Expected N). The residual column represents the difference between the observed and expected frequencies. Based on data processing using SPSS 25.0, the results obtained are:

Tabel 3 Decomposition Test of Intervariable Influences

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			Std. Error	Beta		
1	(Constant)	10.08681	3.0408		3.3170	0.0012
	Public Awareness	0.307419	0.1565	0.343396	1.9633	0.0525

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Environmental Knowledge	0.245192	0.1502	0.285423	1.6318	0.1060
The Beauty Of Local Culture	0.166783	0.0809	0.162973	2.0593	0.0422

a. Dependent Variable: Y

Source: Processed Data, 2025

At the 0.05 alpha level, the Asymp. Sig value is 0.000, which represents the probability value. Since the Asymp. Sig value of 0.000 is less than the alpha level (0.000 < 0.05), the null hypothesis (Ho) is rejected. This indicates that there is a significant difference in the amount of green economy development in the Lake Toba region.

The Influence of Public Awareness (X1) on Green Economy Development (Y) in the Lake Toba Region

In Table 3, it can be seen that the result for the variable of public awareness (X1) shows a Sig. value > 0.05, or 0.0525 > 0.05. Therefore, the hypothesis Ha1 is rejected and Ho1 is accepted, which indicates that public awareness does not have a significant influence on green economy development. This suggests that public awareness has not yet become a key factor in driving the green economy in this region.

Although Lake Toba has high ecological potential, the limited understanding and participation of the community in environmentally friendly practices restrict their contribution. Other factors, such as government policies and investment, may play a more dominant role. Therefore, efforts are needed to educate and empower the public so that awareness can be increased to support the sustainability of the green economy in Lake Toba.

Studies in Saudi Arabia and Malaysia have shown that public understanding of the concept of a green or circular economy remains limited, despite positive attitudes toward environmentally friendly behaviors such as waste separation and recycling (Of and Education, 2025). Education level plays a significant role in raising awareness, while age is correlated with a tendency toward pro-environmental behavior (Almulhim, 2021). Among students, awareness is at a moderate level, but participation in sustainability initiatives remains low

The Influence of Environmental Knowledge (X2) on Green Economy Development (Y) in the Lake Toba Region

As shown in Table 3, the result for the environmental knowledge variable (X2) indicates that the Sig. value is greater than 0.05, or 0.1060 > 0.05. Therefore, the alternative hypothesis (Ha1) is rejected and the null hypothesis (Ho1) is accepted, which means that environmental knowledge does not significantly influence green economy development.

This suggests that although the community may have environmental knowledge, the application of that knowledge in green economic practices remains suboptimal. Factors such as limited access to environmentally friendly technologies, lack of supportive policies, and the dominance of conventional economic activities are key barriers.

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

Therefore, increasing environmental knowledge must be accompanied by training, empowerment, and supportive policies to ensure that such knowledge contributes meaningfully to green economic development in the Lake Toba region.

Green innovation and environmental knowledge management in companies play a major role in improving environmental performance and accelerating the adoption of green economy practices. The acquisition and transfer of environmental knowledge—both through internalization and external networking—have been proven to enhance eco-friendly product and process innovations, as well as strengthen business competitiveness (Sahoo, 2023; Usama et al, 2021).

The Influence of Local Cultural Preservation (X3) on Green Economy Development (Y) in the Lake Toba Region

As shown in Table 3, the result for the local cultural preservation variable (X3) indicates that the Sig. value is less than 0.05, or 0.0422 < 0.05. Therefore, the alternative hypothesis (Ha1) is accepted, and the null hypothesis (Ho1) is rejected, which means that local cultural preservation has a significant influence on green economy development.

This finding highlights that the preservation of local culture is an important factor in promoting the green economy. The strong Batak culture and its deeply rooted local wisdom support sustainable practices, such as the prudent management of natural resources and environmental conservation. The authenticity of local culture fosters a collective awareness among the community to protect the Lake Toba ecosystem, creating a mutual reinforcement between culture and the environment in sustainable green economic development.

A cultural approach is thus a key to the successful development of a green economy in this region. Cross-country studies have found that cultural dimensions such as individualism, uncertainty avoidance, and long-term orientation have a positive impact on the green economy and green innovation (Silo, 2024). Conversely, cultures characterized by high power distance and masculinity tend to hinder green innovation (Yuliani & Setyaningsih, 2025). Cultural diversity also enriches green innovation and strengthens the competitiveness of the green economy.

The Influence of Public Awareness (X1), Environmental Knowledge (X2), and Local Cultural Preservation (X3) on Green Economy Development (Y) in the Lake Toba Region

Table 4: Results of the Coefficient of Determination (R^2) Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics	
					R Square Change	F Change
1	0.636646	0.405318	0.386539	2.579238	0.405318	21.5831
a. Predictors: (Constant), X3, X2, X1						

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

b. Dependent Variable: Y

Source: Processed Data, 2025

Based on Table 4 above, the coefficient of determination (R Square) is 0.4053. This result indicates that the independent variables, namely Environmental Knowledge (X2) and Local Cultural Preservation (X3), explain 40.5% of the variation in the dependent variable, which is green economy development.

This finding suggests that Environmental Knowledge and Local Cultural Preservation make a fairly significant contribution to the development of a green economy. However, there remains room to identify and consider other variables that may also influence green economy development in a more comprehensive manner.

4. CONCLUSION

Based Based on the data analysis conducted on the influence of Public Awareness (X1), Environmental Knowledge (X2), and Local Cultural Preservation (X3) on Green Economy Development (Y) in the Lake Toba region, the following conclusions can be drawn:

1. Public Awareness (X1) does not have a significant influence on green economy development, with a significance value of 0.0525 > 0.05. This indicates that the level of public awareness in the Lake Toba region is not yet strong enough to drive meaningful green economic practices. Awareness remains passive and is not accompanied by active participation in sustainable activities.
2. Environmental Knowledge (X2) also does not show a significant influence on green economy development, with a significance value of 0.1060 > 0.05. This means that although people may have knowledge of environmental issues, it has not yet translated into concrete actions or sustainable innovations. Structural barriers such as limited access to technology and supportive policies also play a role.
3. Local Cultural Preservation (X3) has a significant influence on green economy development, with a significance value of 0.0422 < 0.05. This confirms that local cultural values—particularly those rooted in Batak culture—play an important role in encouraging sustainable practices and environmental conservation. Local wisdom serves as a foundation for maintaining the balance between economic growth and ecological sustainability.
4. Collectively, the three independent variables (X1, X2, X3) explain 40.5% of the variance in green economy development, as indicated by the R Square value of 0.4053. This means that 59.5% of the variance is influenced by other factors not included in the model, which should be explored further in future research.

Research Implication

1. Sustainable Development Policy
   Local governments and policymakers need to consider the importance of cultural approaches when designing green economy policies. Integrating local wisdom into environmental conservation policies can strengthen community support.

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

2. Environmental Education and Outreach
   There is a need to improve the quality of environmental education, not only in terms of theoretical knowledge but also through practical training and community empowerment. Educational programs should be designed to encourage behavioral change, not merely to increase awareness.
3. Empowerment of Local Communities
   Community awareness should be enhanced through direct participation in green economy programs, such as organic farming, integrated waste management, and community-based ecotourism. Active participation can foster a sense of ownership and responsibility for environmental sustainability.
4. Strengthening Local Innovation
   Cultural potential and local knowledge need to be developed into green innovations that support economic growth without harming the environment. Collaboration among government, academia, businesses, and communities is key.
5. Further Research
   There are still other variables that have not been explored but have great potential to influence green economy development, such as regulatory support, the role of the private sector, green infrastructure, and environmentally friendly technology.

5. REFERENCES

Almulhim, A.I. (2021) 'Understanding Public Environmental Awareness and Attitudes toward Circular Economy Transition in Saudi Arabia', pp. 1–15.

Aziz, S. N., Putra, S. S., & Digdowiseiso, K. (2023). The Influence Of Product Quality, Price Perception, And Brand Image On Consumer Repurchase Intentions For Yonex Products.

Batara, J. et al. (2018) 'The effect of FDI and GDP on tax revenue in Indonesia: Panel data analysis 2005–2015', National Public Finance Symposium, 1(1), 603–627.

Elyasi, S. and Yamacli, R. (2023) 'Architectural sustainability with cultural heritage values', 4(2), pp. 55–61. Available at: https://doi.org/10.58598/cuhes.1282179.

Hoang, K.V. (2021) 'The benefits of preserving and promoting cultural heritage values for the sustainable development of the country', 00076.

I.J. and Education, M. (2025) 'EXPLORING GREEN ECONOMY AWARENESS AMONG TVET', 7(24), pp. 1244–1253. Available at: https://doi.org/10.35631/IJMOE.724087.

Khoshnava, S.M. et al. (2019) 'Aligning the Criteria of Green Economy (GE) and Sustainable Development Goals (SDGs) to Implement Sustainable Development'.

Istania, R. and Rahmawati, A. (2023) 'Digitalization of Green Economy Policy Model in Provincial Government', 2023, pp. 480–493. Available at: https://doi.org/10.18502/kss.v8i11.13567.

Lumbanbatu, H.A. (2025) 'The Toba Batak tribe ' s cultural capital in the context of protecting Lake Toba from environmental threats', 2(2), pp. 130–150.

Mandaasari, I.A.C.S. (2019) 'The Impact of Tourism Development on the Economic , Cultural

Multidisciplinary Indonesian Center Journal (MICJO)
Journal page is available to
https://e-jurnal.jurnalcenter.com/index.php/micjo
Email: admin@jurnalcenter.com

and Environmental Aspects of Local Communities', 7(1), pp. 31–36.

Mihaela Clincu, A.B. (2024) 'Boosting the cultural dimension of sustainable development – from grassroots to policy level', 15(1), pp. 219–249. Available at: https://doi.org/10.47743/ejes-2024-0110.

Noviantika, A.Y. and T. (2023) 'The Antinomy of Green Economy Implementation Towards Indigenous People in Natural Resources Management The Antinomy of Green Economy Implementation Towards Indigenous People in Natural Resources Management'. Available at: https://doi.org/10.1088/1755-1315/1270/1/012031.

Novita, A.A., Ngindana, R. and Putra, E. (2024) 'Preserving cultural heritage: Integrating traditional values and local arts for sustainable tourism', Jurnal Inovasi Ilmu Sosial dan Politik (JISoP), 6(1), pp. 68–77. Available at: https://doi.org/10.33474/jisop.v6i1.21925.

Qi, Z. (2024) 'The Impact of the Integration of the Culture Industry and Tourism on Regional Green Development : Empirical Evidence from China'.

Sahoo, S. (2023) 'How do green knowledge management and green technology innovation impact corporate environmental performance ? Understanding the role of green knowledge acquisition', (March 2022), pp. 551–569. Available at: https://doi.org/10.1002/bse.3160.

Silo, A. (2024) 'Green Economic and Local Wisdom toward Sustainable Development in West', 4(1).

Usama Awan, Marlen Gabriele Arnold, I.G. and A (2021) 'Enhancing green product and process innovation: Toward an integrative framework of knowledge acquisition and environmental investment', (September 2020).

Wijaya, R., & Nugroho, A. J. (2022). Mengetahui Pengaruh Kualitas Dan Merek Produk Terhadap Minat Beli Pakaian Bekas Impor. Jurnal Cakrawala Ilmiah, 1(11), 2953–2962

Yuliani, S. and Setyaningsih, W. (2025) 'Green architecture in tourism sustainable development a case study at Laweyan , Indonesia', Journal of Asian Architecture and Building Engineering, 24(1), pp. 27–38. Available at: https://doi.org/10.1080/13467581.2023.2287198.