Investigating the Impact of the of Technological Developments, Environmental Quality, and Economy on Tourism Receipts in Indonesia

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Abstract

This paper uses a panel technique to investigate the relationship between Technological Developments, Environmental, and GDP Quality on Tourism Receipts in Indonesia (including 33 provinces) for the 2011-2022 period. As a country with rich natural, cultural and ancestral heritage, Indonesia has the potential to attract foreign tourists. Especially with technological advancements that have made tourism promotion possible on a massive scale. On the other hand, an increase in the number of tourists has an impact on the environment as explained in the theory of the Environmental Kuznet Curve (EKC). The research method used is Vector Error Correction Model (VECM) model and Granger causality test. Environmental quality is measured through the Environmental Quality Index indicator. Meanwhile, technology development is measured through the Information and Communication Technology Development Index. The research results explain that Economy, Environmental Quality, and Technological Developments have a positive impact on Tourism Receipts in Indonesia. Therefore, it is important for the government to utilize digital technology to introduce Indonesia's tourism wealth. The increase in tourists must also be accompanied by efforts to protect the environment so that it does not have a negative impact on environmental damage.
Keyword: Technological Developments, Environmental Quality, Economy, Tourism Receipts

1. Introduction

Tourism plays a vital role in supporting Indonesia's economic growth. As a country endowed with natural beauty, cultural heritage, and rich historical sites, Indonesia has managed to optimize the potential of tourism as one of the main pillars in its economic growth. The tourism sector not only provides income for the government through taxes and levies, but also creates job opportunities for thousands of people across the country (Heliany, 2019). In addition, the tourism sector also has a strong positive impact on related industries such as hospitality, restaurants, and local crafts.

Indonesia's Tourism Development has shown significant growth in recent years. The increase in foreign tourist visits has become one of the main indicators in the growth of this sector (Prasetyo & Arifin, 2018). Support from various government programs, such as tourism promotion and infrastructure development, has strengthened Indonesia's appeal as a major tourist destination in the Southeast Asian region. In the period 2015-2019, the amount of foreign exchange from the Indonesian tourism sector increased, thus creating a consistent source of income for the national economy. Even so, the amount of tourism foreign exchange had decreased in 2020 due to Covid-19. This normally occur due to restrictions on interaction activities by the government.
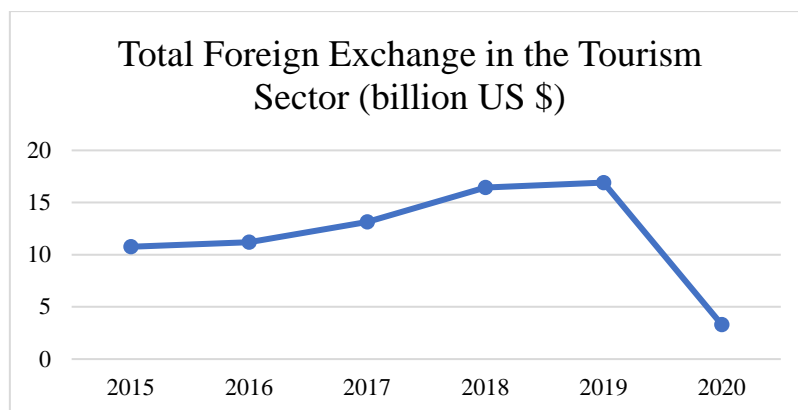
Pictures. 1. Total Foreign Exchange in the Tourism Sector
Source: Central Bureau of Statistics, 2023

In addition to the direct economic benefits derived from the tourism sector, there are also indirect benefits that are very impactful. The increase in tourist visits spurred the development of supporting industries such as agribusiness, handicrafts, and local trade (Mahadeven & Nugroho, 2018). Local people get new opportunities in selling their products and services to tourists, which in turn increases their income and standard of living. It also contributes to improving the quality of life in tourism areas, such as the preservation of culture and the environment, as well as the development of basic infrastructure. Therefore, the development of tourism should always be encouraged, one of them with the efforts of technological development.

Technological development has changed the landscape of the tourism industry significantly in recent decades (Ukpabi & Karjaluoto, 2017). Advances in information and Communication Technology have played a crucial role in changing the way travelers plan, experience, and interact with travel destinations. The ease of obtaining information is the main

cause of this. The easier people get information, the more rapid the development of a tourism object. This phenomenon inspires the need to analyze the impact produced by technological developments on the tourism sector.

First, technology has provided new opportunities in terms of promotion and marketing of tourist destinations. Through online platforms such as websites, social media and travel apps, tourist destinations can easily promote the attractions, facilities and experiences offered to potential tourists around the world (Saniati at all, 2022). This allows smaller or lesser-known destinations to gain greater exposure, resulting in diversification and increased tourist visits.

Secondly, technological innovations have changed the experience of tourists during their travels. The use of travel apps, digital maps, GPS-based guides, and review sharing platforms provides traveler with the ease of exploring destinations with more confidence and efficiency (Himawan, 2015). In addition, technologies such as virtual reality and augmented reality have opened up new opportunities in the virtual travel experience, allowing traveler to explore destinations before they actually get there.

Finally, technological developments have also penetrated the management and operational aspects of the tourism industry (Nuryyev, 2020). Hotels and accommodations use an online reservation system that makes it easy for tourists to book a place to stay. Integrated destination management systems and advanced analytics tools assist stakeholders in managing visitation, anticipating trends, and improving operational efficiency (Wang & Zhang, 2016).

Overall, the impact of technological development on the tourism sector is very broad. From promotion to travel experiences, as well as operational management, technology has changed the way the tourism industry operates. In-depth study of these impacts is becoming increasingly important in the face of ever-evolving challenges and opportunities in this digital age.

H1: technology development has a positive impact on tourism acceptance

Environmental Quality has a very important role in determining the sustainability and attractiveness of a tourism destination (Cianga & Sorocovschi, 2017). In recent years, increasing awareness of global environmental issues has prompted greater attention to the environmental impact on the tourism sector. Therefore, an in-depth analysis of how environmental quality can affect key aspects in the tourism industry is essential.

First, the quality of the environment has a direct impact on the tourist attractions and experiences offered by the destination (Streimikiene, 2021). Natural beauty, biodiversity and environmental sustainability are important elements that attract tourists to visit a place. Environmental degradation such as damage to nature, pollution, and damage to ecosystems can reduce the attractiveness of destinations, resulting in a decrease in tourist visits and income that has the potential to harm the local tourism sector (Azaam & Hafiiz, 2018).

Second, Environmental Quality aspects also have an impact on the image and reputation of a tourism destination. Travelers are increasingly aware of the environmental impact of their travels and tend to choose destinations that have a commitment to sustainable practices and environmental preservation (Sinclair, 2015). Destinations that invest in Environmental Conservation have a greater chance of attracting more environmentally conscious market segments and having a long-term positive impact on their attractiveness and competitiveness.

Finally, environmental issues can influence government regulations and policies towards the tourism sector. Governments tend to implement strict rules to protect vulnerable environments and ecosystems, which in turn can limit the development of tourism infrastructure or activities that have the potential to damage the environment (Streimikiene att all, 2021). Environmental impact management and mitigation are becoming increasingly important in maintaining a harmonious relationship between economic growth through the tourism sector and environmental sustainability.

Broadly and thoroughly the quality of the environment plays a central role in the long-term success of the tourism sector. The complex relationship between environmental conservation, tourist attractions, destination image, and government regulation highlights the need for a more in-depth study of the impact of Environmental Quality on the tourism sector, in order to formulate strategies that are sustainable and have a positive impact on all stakeholders

H2: if the quality of the environment increases, tourism revenue will increase

The economic influence on a country's tourism is a complex dynamic of interdependence. Stable economic growth can make a positive contribution to the tourism sector by increasing people's purchasing power, thereby driving demand for tourism services (Scarlett, 2021). Conversely, economic instability, such as a recession or high inflation, can hurt the tourism industry by reducing tourist spending and discouraging investment in the sector. Economic conditions also affect currency exchange rates, which can affect the purchasing power of foreign tourists (Işik & Radulescu, 2017). In addition, the government's fiscal and monetary policies, such as taxes and interest rates, play a role in shaping the investment climate in the tourism sector. Therefore, a deep understanding of economic dynamics is essential in designing sustainable and profitable tourism development strategies for a country.

H3: economy has a positive influence on tourism acceptance

2. Literature Review

2.1 Tourism

A review of key concepts in the relationship between Tourism and the economy includes the multiplier effect, which describes the chain effect of tourist spending that strengthens local economic activity. This approach considers increasing the initial expenditure of tourists, push the growth of related sectors such as hospitality, transport, and local agriculture (Berati & Branch, 2016). Economic diversification, as an important concept, will also be reviewed to reduce dependence on one sector of the economy by developing other sectors, such as the creative industries and the promotion of local products. In addition, the role of the tourism sector in local development is emphasized, focusing on contributing to local revenue, infrastructure improvements, and job creation (Shaliza & Sharida, 2023). Involving local communities in the planning of tourism projects is also considered crucial to ensure equitable and sustainable economic benefits in the long term. Thus, these main points form the theoretical

basis for understanding the dynamics of the relationship between Tourism and economic growth

2.2 Environmental Quality

Environmental Quality plays a central role in supporting the stability and economic growth of a country (Yuda & Idris, 2022). Healthy and maintained ecosystems provide fundamental ecosystem services, such as clean water supply, climate regulation, and the availability of Natural Resources. Good economic sustainability often depends on the availability and sustainable use of Natural Resources, and good Environmental Quality supports the productivity of economic sectors. In addition, aspects such as biodiversity also play an important role in providing resilience to environmental changes and reducing the risks associated with economic uncertainty. Therefore, the understanding and maintenance of Environmental Quality is a prerequisite for sustainable economic development.

On the other hand, a decrease in the quality of the environment can have a serious impact on economic stability. Air, water, and soil pollution can cause significant economic losses through health costs, decreased agricultural productivity, and degradation of Natural Resources (Santi & Sasana, 2021). Climate change caused by human activities can also disrupt production and distribution patterns, increase the risk of natural disasters, and cause financial losses. Therefore, the protection and improvement of Environmental Quality is not only an ethical and moral responsibility, but also an intelligent economic policy to ensure long-term economic sustainability and resilience. In this context, the development of policies that combine economic growth with environmental conservation is becoming increasingly crucial for the global future

2.3 Technology Development

Technological development affects economic growth in line with the concepts of neoclassical economic growth theory and endogenous growth theory. According to neoclassical economic growth theory, increased productivity resulting from technological development will lead to long-term economic growth (Oktavia, 2020). Technology allows factors of production, such as capital and labor, to be used more efficiently, increasing output per hour worked, and thus increasing total factor productivity. With increased productivity, society can experience sustainable economic growth.

Meanwhile, endogenous growth theory emphasizes the importance of innovation and investment in research and development as drivers of economic growth. Technological development, often generated through innovation activities, is key in the theory of endogenous growth. Technological innovation not only fuels immediate growth, but also creates sustainable positive effects as innovation leads to human capital formation, innovative capacity building, and the expansion of the technological frontier (Amirina & Primandhana, 2022). By adopting new technologies, countries can achieve sustainable economic growth, following the concept of positive externalities in the theory of endogenous growth. Thus, technological development not only conforms to the principles of neoclassical economic growth theory which highlights the efficiency of factors of production, but also supports the concept of endogenous growth theory which emphasizes the key role of innovation in spurring long-term economic growth.

3. Material and Methods

3.1 Design Study

In this study the research method will be very closely related to the purpose of the study. The method used is analysis Vector Error Correction Model (VECM) with the main purpose of this study is to determine the variables that can affect (determinants) of tourism revenue in Indonesia.

3.3 Data Analysis

In order to achieve this goal, the determinants of Tourism acceptance, namely technological development, environmental quality and economic conditions, act as the dependent variable. This research uses panel data from 33 provinces in Indonesia which is reflected through data from 2012-2022.
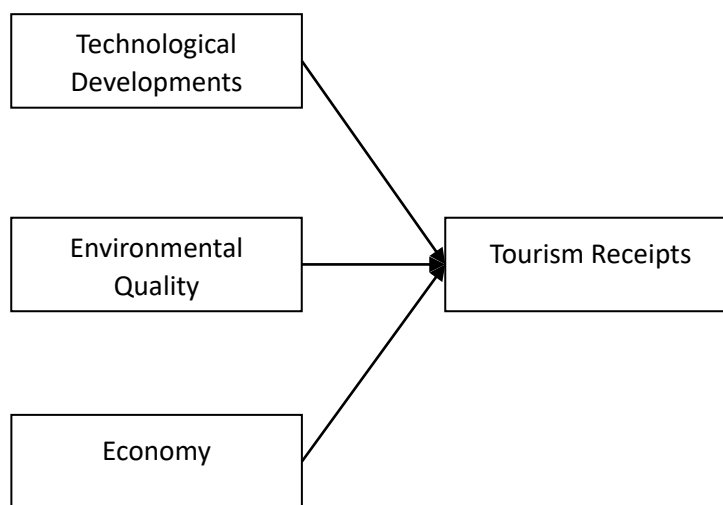
Pictures 1 Research Design

Tabel 1 Attribute of Variables

Code	Variable	Specification	Measurement	Source
ROT	Revenue on Turism	Income from the tourism sector	Rp Trilion	BPS
IPTIK	Technological Developments	Technology development data released annually	Base Point →%	BPS
ILH	Environmental Quality	Water Quality Index (IKA), Air Quality Index (IKU), Land Cover Index	Base Point →%	Kementrian Lingkungan Hidup
PDB	Economy	Gross Domestic Product (GDP) per 33 provinces	Rp Trilion	BPS

Next, the VECM method is carried out procedurally starting from the stationarity test, selecting the optimum lag, VAR stability test, causality test (Granger approach), model

estimation VECM, analisis Impulse Response Function (IRF), and ends with Forecast Error Variance. Decomposition analysis (FEVD). The VECM mathematical Model used in this study is:

$$ROT_t = \sum \alpha 1. ROT_{t-i} \; n \; i{=}0 + \sum \alpha 2. IPTIK_{t-i} \; n \; i{=}0 + \sum \alpha 3. ILH_{t-i} \; n \; i{=}0 + \sum \alpha 4. PDB_{t-i} \; n \; i{=}0 + \varepsilon_t \quad (3)$$

The hypothesis of the study on the influence of the Environmental Index (ILH), Information Communication Technology Development Index (IPTIK) and the economy as seen from the Gross Domestic Products, evidenced by assessing the response of the movement of each variable (up or down) in the analysis of IRF. While the significance of the influence between variables seen by comparing t statistics with T tables. Stationarity test is very important in research with panel data. This test serves as a step that is able to show the stability of data changes. Non-stationary Data can potentially result in Invalid models.

Then, the basic assumptions that must be met in the stationarity test also serve as a determination of the feasibility of using the model in the VECM method. data that is only stationary at difference level 1 should be followed by cointegration test and estimation using Vector Error Correction Model (VECM). While if the data is stationary at the level then it can be used VAR model.

4. Results

Table 2 Result of Stationary Testing on VAR Data by ADF Test

prob. Value	Variable			
	IPTIK	ILH	PDB	ROT
Level	0.0000	0.0000	0.8073	0.0084
1st Difference	0.0000	0.0000	0.0000	0.0000

*p-value <0.05

In the analysis of panel data involving 33 provinces in Indonesia using Eviews software, this study found that the results of the stationarity test showed that the data is stationary at the first difference level. The transformation of the first difference level in the time series of the provinces proves its effectiveness in achieving a stationary nature, which is essential in detailing the dynamics of the regional economy. This transformation process plays an important role in eliminating trends or patterns in the initial panel data, allowing the use of more precise and relevant statistical models. These findings not only provide a solid basis for further analysis, but also improve the sustainability of research results in the context of scientific research. These conclusions make a significant contribution to the understanding of economic change at the provincial level in Indonesia, opening up opportunities for further research that can explore important relationships and factors within the context of the panel's dataframe.

Table 3 Result of Lag Optimum Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4978.480	NA	1.30e+19	55.36089	55.43184*	55.38966*
1	-4963.437	29.24975	1.31e+19	55.37152	55.72630	55.51537
2	-4947.213	30.82542	1.31e+19	55.36903	56.00763	55.62796
3	-4933.501	25.44369	1.34e+19	55.39446	56.31686	55.76845
4	-4903.085	55.08671*	1.15e+19*	55.23428*	56.44051	55.72335

*selected optimum lag

The results of the lag selection test showed that lag 4 is the most optimal lag for inclusion in the model. These results indicate that in the context of the model, the lag of the previous four periods has a significant and relevant impact on the response variable. Choosing the right lag is crucial in building an accurate model and providing a good picture of the relationship between variables in a system. The decision to choose lag 4 was supported by statistical analysis that took into account the trade-off between the accuracy of the model and its complexity. Thus, these findings provide a solid foundation for designing better models, taking into account the impact of variables that occurred in the span of the previous four periods. This conclusion makes an important contribution in the context of the interpretation of the results and the reliability of the models used in the data analysis.

Table 4 Result of VECM Stability Model

Root	Modulus
-0.246884 - 0.335855i	0.416833
-0.246884 + 0.335855i	0.416833
0.181668 - 0.310895i	0.360082
0.181668 + 0.310895i	0.360082
-0.321360	0.321360
0.300161	0.300161
-0.093115 - 0.237434i	0.255040
-0.093115 + 0.237434i	0.255040

The results of the modulus test, which gives an idea of the stability of a model or time series, show values that are less than 1. These results give an indication that the data are in stable condition. Modulus tests that produce values less than 1 indicate that small changes in the variables in the model do not result in significant changes or expand exponentially. This

conclusion reinforces the interpretation that the observed model or time series has a sufficient degree of stability, so that it can be considered a reliable representation of the phenomenon that is being observed. The results of the modulus test, which showed a stable condition, provided a high basis of confidence in the interpretation of the analysis results.

Table 5 Result of Granger Causality Test

Variable	F. Statistics Prob.Value			
	ROT	IP-TIK	ILH	PDB
ROT	-	0.1214	0.2965	0.5533
IP-TIK	0.0047	-	40.005	0.2950
ILH	0.0008	40005	-	0.0001
PDB	0.0114	0.2950	0.0501	-

Thickness 5 indicates the probability of the effect of each variable on other variables. The effect of Technology Development Index on tourism receipts has a probability value of less than 0.5 so that it can be interpreted that technological development is able to increase the value of tourism receipts in the Indonesian economy. Similarly, the results of the Environmental Index test show that there is a significant effect of increasing or decreasing environmental quality can affect tourism acceptance. As for the gross domestic product also produces a probability of less than 0.5 so it can be interpreted that the economy has a significant increase in tourism receipts.

Table 6 Result of VAR

| Variable:	D(ROT)	D(ILH)	D(IPTIK)	D(PDB)
D(ROT (-1))	-0.813794	-5.036685	-0.006773	-537.0352
(S.E)	(0.14749)	(1.48638)	(0.00185)	(823.057)
[t stat]	[-5.51760]	[-3.38855]	[-3.66190]	[-0.65249]
D(ILH (-1))	0.040624	0.060858	0.001378	207.3050
(S.E)	(0.01521)	(0.15328)	(0.00019)	(84.8781)
[t stat]	[2.67089]	[0.39703]	[7.22531]	[2.44239]
D(IPTIK (-1))	36.98831	855.3348	0.365885	182614.5
(S.E)	(13.4124)	(135.168)	(0.16820)	(74846.7)
[t stat]	[2.75777]	[6.32794]	[2.17530]	[2.43985]
D(PDB (-1))	1.14E-05	0.000680	8.51E-07	-0.832486
(S.E)	(2.3E-05)	(0.00024)	(2.9E-07)	(0.13083)
[t stat]	[0.48743]	[2.87982]	[2.89335]	[-6.36303]
R-squared	0.501294	0.667217	0.734775	0.510564

After estimating with VECM, Environment Index (ILH) variable showed positive response (increase) to tourism acceptance variable. This result is consistent with the established hypothesis (hypothesis 1). There was an increase in the contribution of the Environmental Index by 12.35% in the 12th month and increased to 17.57 percent in the 24th month. The

influence of Technology Development also increased to contribute 11.95% in the 24th month from the previous 8.99 in the 12th month. This means that technological development has a long-term impact on tourism acceptance variables.

Table 7 Result of Forecast Error Variance Decomposition (FEVD)

Variable	Period	S.E.	D(ROT)	D(ILH)	D(IPTIK)	D(PDB)
ROT	1	52.44495	100.0000	0.000000	0.000000	0.000000
	12	88.08591	74.28492	12.35423	8.959689	4.401161
	24	110.8880	64.28268	17.57336	11.954862	6.189097
ILH	1	528.5314	0.680146	99.31985	0.000000	0.000000
	12	807.1436	12.02338	58.11245	16.44215	13.42202
	24	917.3627	10.71363	55.85213	20.12794	13.30631
IPTIK	1	0.657692	11.20402	3.400278	85.39571	0.000000
	12	0.992412	13.14061	34.88350	48.24093	3.734970
	24	1.156890	15.81035	39.54080	41.61894	3.029909
PDB	1	292664.1	49.79952	0.850316	0.638509	48.71166
	12	424784.5	48.35005	6.506105	3.078276	42.06557
	24	508530.7	48.28927	6.488367	3.193704	42.02866

Variable Economic variables that are reflected through the Gross Domestic Product (GDP) showed a positive response to tourism revenue variables. These results prove that hypothesis 3 is accepted. The response movement lasted 24 months. This respon looks stable and not close to 0 points, meaning that economic variables have a long-term impact on tourism revenue variables. In the 12th month the economic contribution was 4.4% while in the 24th month it was 6.19%. It can be interpreted that there is an increase in contributions of 1.79%.

Variance Decomposition using Cholesky (d.f. adjusted) Factors
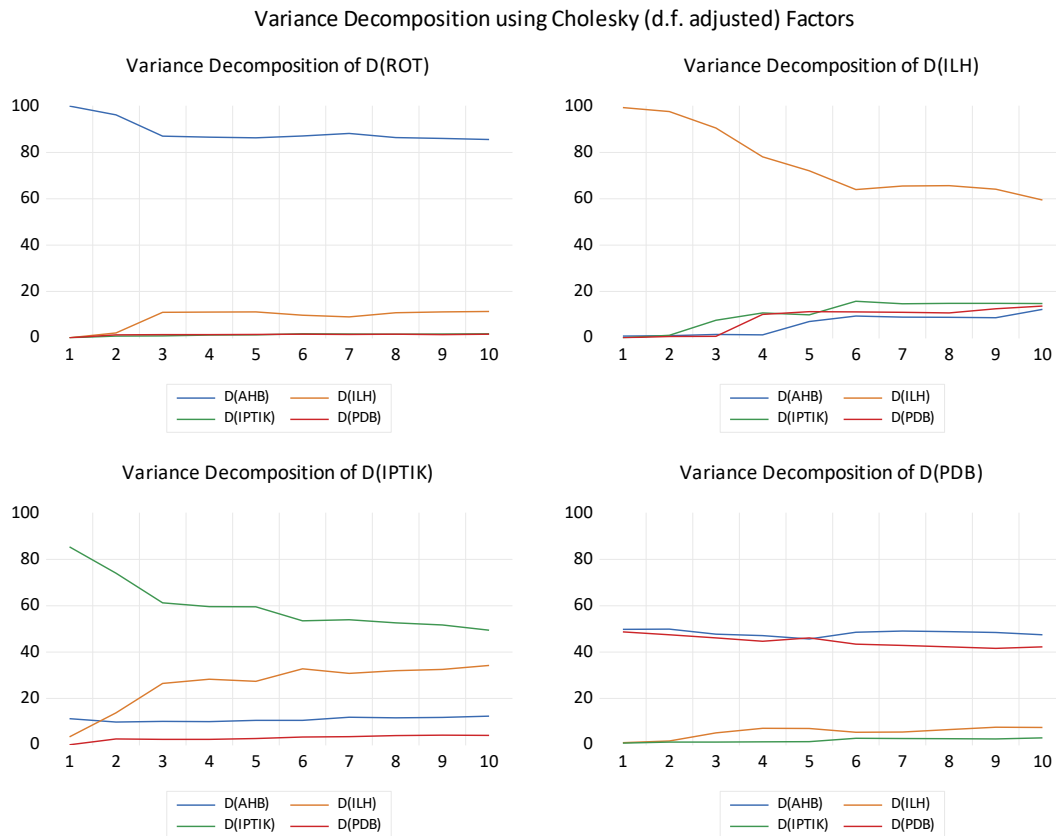
Picture 2 Graph of Impulse Response Function

5. Discussion

This study shows that improvements in technological development, environmental quality and economic strengthening can have an impact on increasing tourism receipts. Previous research by Cvetkovski (2021) stated that technology is indeed crucial in encouraging the tourism sector. Meanwhile, the environment also has a big influence on people's decisions to visit an area (Seyidov, 2016). In line with research by Fafurida att all (2020) which shows that tourism and the economy as seen from Gross Domestic Product are also very large.

6. Conclusion, Implication, and Recommendation

Based on the analysis of panel data on 33 provinces in Indonesia using Vector Error Correction Model (VECM), it can be concluded that the three indicators, namely the Environmental Index (ILH), Information Communication Technology Development Index (IPTIK) and the economy as seen from the gross domestic product, have an influence on tourism acceptance variables. The three variables in the long term have the effect of tourism revenue to respectively pasing of 17.57%, 11.95%, 6.19%. For this reason, it is important for the government to improve performance in order to realize technological development, environmental management and economic empowerment in a sustainable manner in order to increase tourism acceptance in Indonesia.

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