



THE INFLUENCE OF KNOWLEDGE ECONOMY AND CULTURE ON ECONOMIC RESILIENCE AND SUSTAINABLE DEVELOPMENT IN INDONESIA

Nefo Indra Nizar^{1*}, Ahmad Nazir², Achmad Nur Sholeh³

dosen01424@unpam.ac.id, dosen01631@unpam.ac.id, dosen01531@unpam.ac.id

Fakultas Ekonomi dan Bisnis, Universitas Pamulang, Tangerang Selatan, Banten,
Indonesia

ABSTRACT

The purpose of this study is to find out whether the knowledge economy and culture are able to overcome the problems of economic resilience and sustainable development in Indonesia. The knowledge economy is a knowledge-based development built on a knowledge framework, while the cultural economy is based on a cultural economy framework. Economic resilience is needed so that sustainable development can run well. Economic resilience is able to maintain economic growth while strengthening sustainable development with the procedures of the knowledge economy and cultural economy. The research method uses Generalized Least Square regression estimation to measure the influence of knowledge economy and culture variables on economic resilience and sustainable development in Indonesia. From the results of the study, the variables of the knowledge economy and culture have a positive and significant effect on economic resilience and sustainable development in Indonesia. This study includes the variables of education, technology, innovation, aspects of democracy, and cultural heritage as proxies for the knowledge economy and culture. Sustainable development requires sustainable economic resilience in addition to the knowledge economy and culture. Sustainable economic resilience through technology and innovation will be able to survive and develop again so that sustainable development can continue to run and overcome shocks that will always appear in the economic cycle. The addition of determinants of innovation, cultural economy and sustainable development in Indonesia can strengthen the economic resilience variables and complement economic resilience to be better and unique.

Keywords: Economic Resilience; Sustainable Development; Knowledge Economy, Cultural Economy.

INTRODUCTION

Knowledge as an economic resource has been widely recognized. The concept of knowledge economy emerged when knowledge and information technology were recognized as important resources in economic activities and is rooted in information theory to postindustrialism theory (Jadranka & Marina, 2015). The knowledge economy can be distinguished from the traditional economy and from abundance. The knowledge economy is related to abundance, while the traditional economy is related to scarcity. There is no distinctive characteristic of the definition of a knowledge-based

economy, but it is agreed that knowledge is information that can increase productivity and the exploitation of knowledge can provide new value in the economy.

While cultural economy is the relationship between culture and economic results. Culture contributes to economic performance and development. Culture has a very broad meaning. Mokyr (2017) defines culture as a set of beliefs, values, and preferences, which are able to influence behavior, are socially inherited and owned by several groups of people.

One of the challenges faced in economic development is the emergence of disruptions and shocks in the economic cycle. Many factors cause economic shocks. Sutton & Arku (2022) mention at least seven types of disruptions, namely: economic, institutional, organizational, environmental, human actions, technological disruption and epidemics. The Russo-Ukrainian war has threatened the emergence of a food and energy crisis. Global economic conditions are deteriorating. The inflation rate has risen sharply to the highest level, even some countries have been declared bankrupt because they are unable to repay their debts.

In relation to shocks and disruptions in the economic cycle, economic resilience is one of the main topics and is the center of research. Economic resilience is the ability of the economy to survive and then recover economically. Shocks usually come suddenly, although previously anticipated, but not well prepared. OECD (2020) proposes a systemic resilience system approach, not only to address the problem of the Covid-19 pandemic, but also future shocks.

Investment in education, technology and innovation are some of the most widely used determinants of economic resilience. Wang & Li's (2022) research uses innovation and human capital determinants in addition to income inequality, government intervention and finance as determinants of economic resilience. Meanwhile, Oprea et al (2020) one of the determinants of economic resilience in his research uses higher education variables. On the other hand, several studies use cultural factors and social capital as determinants of economic resilience (Cellini & Cuccia, 2018; Bastaminia et al (2017). Culture plays an important role in the development of knowledge. Mokyr (2017) states that culture has been able to change the dark ages in Europe into an era of enlightenment and ultimately gave birth to the industrial revolution.

Indonesia's development work plan in 2022 is on economic resilience for quality, equitable, and sustainable economic growth. The role of culture and its management is very important for sustainable development programs. Sustainable development not only pursues current economic growth, but also for human welfare in the future. The Covid-19 pandemic in Indonesia provides valuable experience to provide a deeper understanding of development by paying attention to environmental, health, social, and governance aspects of all economic activities.

Development activities while maintaining balance with the environment are very important. Law of the Republic of Indonesia Number 23 of 1997 concerning the environment states that it is deemed necessary to implement environmental management to preserve and develop environmental capabilities that are harmonious, in tune, and balanced in order to support the implementation of sustainable development that is environmentally aware. The balance of human life,

development and the environment is often found in the form of local wisdom which is one of Indonesia's cultural heritages.

Knowledge and culture are closely related. There are two dimensions of knowledge creation, namely explicit knowledge and tacit knowledge. Explicit knowledge is knowledge that is taught formally, while tacit knowledge is knowledge based on experience. Local wisdom is tacit knowledge that is taught from generation to generation in certain communities. Local wisdom contains a value system and knowledge system that supports the sustainability of the existence of various natural resources and a sustainable lifestyle for all living things and the environment. In one of the tribes in Indonesia, there is a cultural heritage in the form of traditional house construction that illustrates earthquake mitigation. Local wisdom is one form of intangible cultural heritage registered with the Indonesian Ministry of Education and Culture.

Economic resilience is absolutely necessary for a country or region. With strong economic resilience, sustainable development can be implemented. There are at least two approaches to thinking related to resilience, namely the economic approach and the evolutionary approach. Some writings related to resilience with an economic approach are Rose & Krausmann (2013) and Hallegatte (2014). If Hallegatte only divides economic resilience at the household level (microeconomics) and in aggregate (macroeconomics), Rose & Krausman (2013) add economic resilience at the market level (mesoeconomics). However, both agree that economic resilience is dynamic, namely the ability to reconstruct, restore and then return to a new balance (equilibrium).

Economic resilience thinking with the perspective of evolutionary theory assumes that economic resilience is an evolutionary process. Economic resilience can be divided into four dimensions of economic resilience to shocks. Martin & Sunley (2015) state that economic resilience is the capacity of a regional or local economy to be able to withstand or recover from market, competitive, environmental shocks, and then return to the growth path through a process of adaptive change to economic, social structures, and institutional arrangements to maintain and restore to the previous growth path, or to a new sustainable growth path.

Indonesia first announced the corona case in March 2020. Covid-19 has an impact on economic activities. There are shocks and disruptions due to restrictions on economic activities. Based on data from the Central Statistics Agency of Indonesia, economic growth contracted and experienced negative economic growth in 2020 of -2.07 percent. The growth rate of Gross Domestic Product by business sector after the first quarter throughout 2020 showed that almost all business sectors experienced negative growth rates. Several business sectors, such as the Agriculture, Information and Communication, Education Services sectors, showed relatively good economic resilience during the Covid-19 pandemic.

In the previous period, Indonesia experienced economic shocks and recessions twice, namely in 1963 and 1998. Based on data from the Central Statistics Agency of Indonesia, the first shock and recession occurred in 1963 due to economic and political shocks. In this year, Indonesia experienced hyperinflation reaching 119 percent. Gross Domestic Product grew negatively -3.95 percent. Furthermore, in 1998, disruption and recession due to the financial crisis. Almost all countries in Asia experienced a very

deep contraction. Indonesia experienced a contraction of up to -13.13 percent. The financial crisis in 1998 resulted in the fall of the New Order government which had ruled for 32 years and the occurrence of social and political crises.



Figure 1: Indonesia's Economic Growth 1961 – 2021

Source: Central Bureau of Statistics of Indonesia

The economic development of a country and region does not only rely on natural resources, or on one economic sector. Planning is needed for the economic structure of the country and region according to the strength of the resources they have. Several studies have shown that there is a transformation of the economy based on natural resources and oil to a knowledge-based economy. Countries that rely on an oil-based economy are restructuring their economy and paying more attention to a knowledge-based economy (Nurunnabi, 2017; Amirat & Zaidi, 2019; Mutanov et al 2020).

Several international organizations have developed knowledge-based economy frameworks to help measure the contribution of the knowledge economy to a country's development. The World Bank is one of the international institutions that developed a knowledge economy framework consisting of 4 pillars of knowledge, namely: education, technological infrastructure, innovation systems and institutional systems.

While the cultural economy is the relationship between culture and development. One form of cultural capital is cultural heritage. UNESCO builds a cultural economy framework into the cultural domain and domains related to culture. Tourism is one of the domains related to the cultural domain. One of the relationships between culture and development performance is from the appeal of culture through tourism.

To measure the role of culture in development is not linear, but is done through a transmission process. To see the influence of culture on economic results using several transmissions, namely the values adopted by society, the level of trust, beliefs held and political preferences. Based on this transmission process determines the pattern of behavior in economic activities, transactions, and the choice of decisions taken, then affects economic performance. Cultural heritage in tangible and intangible

forms has an extraordinary attraction for both domestic and foreign tourists to visit, then in turn is able to generate foreign exchange for the country.

Based on the description of the background of the problem above, there are four research formulations that influence each other, namely knowledge economy, cultural economy, economic resilience and sustainable development. Economic resilience and sustainable development as dependent variables, while knowledge economy and culture as independent variables. The purpose of the study is to determine the influence of knowledge economy and culture on economic resilience and sustainable development in Indonesia.

This article is divided into five parts. The first is an introduction containing a brief description of the problem to be studied. The second is a review of literature relevant to this study. The third is related to the methodology used. The fourth is the research results, discussion, and discussion. The fifth is the conclusion of this study.

Economic Resilience

Economic resilience is the stability of the concept of resilience and stability in ecological systems that are widely used in various fields. Resilience is the persistence of disturbances that arise. In other writings, it is stated that in complex economic, ecological and social systems, there is an adaptive capacity which is the system's resilience to unexpected disturbances and shocks. While the concept of resilience seen from the perspective of economic evolutionary theory is a process of evolution from one stage to another.

Meanwhile, Boschma (2015) emphasized that the concept of resilience is not just a recovery to achieve a new balance, but more about the process of finding new growth paths. To achieve this, the importance of local knowledge networks that include geography, organization, social cognitive, and institutions. Martin & Sunley (2015) stated that resilience can be divided into three parts, namely: (1) the ability of the system to return to its original condition due to disturbances; (2) the ability to absorb disturbances; (3) the ability to adapt to disturbances and shocks that arise.

The ability of a system to return to its original condition due to disturbances is also called engineering resilience. Like the law of economic equilibrium, movements from both the demand and supply sides will lead to a new equilibrium. Failure to restore equilibrium can be interpreted as market failure. In the resilience section as the ability to absorb disturbances is the concept of ecological resilience. The ability to absorb disturbances requires that the system is still in its initial equilibrium condition. When disturbances or shocks exceed the ability to absorb, a new equilibrium path will occur that is different from the previous equilibrium. Adaptive resilience is the ability of the system to anticipate and adapt quickly to disturbances and shocks that arise. The ability to maintain some of the main functions or performance of a system. Adaptive resilience is also called evolutionary resilience.

Research by Tan et al., (2017) divides economic resilience into three stages, namely: (1) Persistence stage; (2) Adaptability stage; and (3) Transformation stage. Persistence refers to the capacity of the system to recover and return to its original system structure after a disturbance. At the Persistence stage, it is influenced by disturbances and system vulnerabilities. Disturbance factors can be in any form, economic, political, social, natural disasters and also health, such as outbreaks, infectious diseases such as the Covid-19 pandemic. The Adaptation stage refers to the

capacity of the system to learn, combine experience and knowledge, and continue to develop on previously formed paths. While the Transformation stage requires novelty and innovation to be able to create new resilience paths, because the resilience of the old system can no longer be maintained. Tan et al (2017; 2019) developed a conceptual model of resource-based economic resilience to measure economic resilience based on evolutionary theory and divide regional economic resilience based on certain stages and the factors that influence it.

Similar research was conducted by Oprea et al (2020) in their model dividing economic resilience into resistance and recovery. The difference is that the unit of analysis is based on the economic sector, such as agriculture, manufacturing, services, public administration, entrepreneurship, education, physical capital and urbanization. Wang & Li (2022) from their research results provide evidence for the government to design regional-based policies by considering the size and economic resources of the region to build a strong wall to withstand external shocks and form the basis for creating sustainable development. Meanwhile, Bristow & Healy (2018) concluded in their research that leaders who have the capacity to innovate are strong determinants of regional economic resilience.

The theory of regional economic resilience evolution is widely used as a reference to analyze economic resilience based on its stages. Martin (2012) divides economic resilience into four dimensions of regional economic resilience, namely: (1) resistance; (2) recovery; (3) re-orientation and (4) renewal. The resistance stage is the degree of sensitivity or depth of the regional economy's reaction to recession shocks: the scale of output decline, employment. While recovery is the speed and level of recovery of the regional economy from a recession shock; and then returning to the pre-recession growth path. The third stage is the level of re-orientation and adaptation of the regional economy in responding to recession shocks, changes in industry, technology and workforce composition, business models, work practices. The last is renewal, the extent to which the regional economy renews its growth path: the resumption of the adjustment path and shifting to a new growth trend.

Regarding the relationship between cultural economic resilience, Cellini & Cuccia (2018) found differences in the economic resilience of regions with high cultural behavior and participation have stronger economic resilience compared to other regions with less cultural behavior. Entrepreneurs in the cultural industry are resilient to disruptions and shocks. On the demand side, the presence of museums, theater performances and cinema screenings has a positive and significant relationship with job resilience indicators. On the supply side, the presence of book editors and the supply of theater and cinema performances shows a positive correlation with labor absorption.

Bastaminia et al. (2017) studied the relationship between social capital and economic resilience due to shocks caused by major natural disasters. The results of their research found evidence that social capital is the most important determinant of resilience. Meanwhile, Kimhi et al (2020) highlighted the problem of economic resilience due to the shock of the Covid 19 pandemic. According to Kimhi et al. (2020) economic resilience can be divided into three levels of resilience, namely resilience at the individual level, resilience at the community level and resilience at the national level. In addition, the contribution of demographic characteristics to the impact of the

Covid-19 threat was also taken into account. The results of his research showed that the highest decline in national resilience was due to the low trust of respondents in government decisions during the Covid-19 crisis.

Cultural economic development has great potential to build resilience at the local level, but requires policies tailored to the unique challenges faced by local cultural economies, especially micro and small businesses, if it is to achieve its potential successfully. Frank & Apollonia (2016) analyzed several aspects of culture related to risk and vulnerability. Individualism/collectivism, religiosity and cultural heterogeneity were the cultural aspects analyzed. Variables measuring these cultural aspects were consistently correlated with measures of risk and vulnerability. Further investigation revealed that religiosity, and to a lesser extent cultural heterogeneity, may contribute to explaining differences in national resilience. Frank & Apollonia (2016) discussed the hypothesis that culture influences people's trust and propensity to cooperate, which are important inputs to resilience.

Economic Resilience with Sustainable Development in Indonesia

Economic resilience is part of the concept of sustainable development. Resilience is a way of thinking and acting to achieve sustainability. The concept of sustainable development, which was formulated based on the United Nations Brundland document in 1987, essentially emphasizes the need for a balance between development and the environment. Development goals are oriented towards long-term development. Development results are not only able to meet current needs, but also able to provide for the needs of future generations.

There are three possible relationships between resilience and sustainability in the ecological context. First, system resilience is necessary, but not sufficient for sustainability. Second, system resilience is sufficient, but not necessary for sustainability. Third, system resilience is neither necessary nor sufficient for sustainability. Fourth, resilience is both necessary and sufficient for sustainability. The implications of these conclusions emphasize that policy makers in setting sustainable development plans and goals at the national and regional levels should include aspects of resilience as a key factor in the success of implementing sustainable development.

Indonesia has a strong commitment to implementing sustainable development programs both nationally and regionally. Several laws to support the achievement of sustainable development goals have been made with priority on aspects of sustainability and environmental sustainability. Law No. 32 of 2009 concerning Environmental Protection and Management, Law No. 41 of 1999 concerning Forestry, and Law No. 18 of 2013 concerning Prevention and Eradication of Forest Damage. In addition, to support sustainable development, the Green Economy Index has been created as a measuring tool for achieving high economic growth while maintaining the quality and carrying capacity of the environment.

Indonesia has a strong foundation in implementing the concept of sustainable development. Many forms of local wisdom have taught how to balance development with the environment. The concept of sustainable development can be found in various regions in Indonesia (Abdoellah, 2016), such as the Sundanese people in West Java, the Badui people, Kampung Naga, Kampung Kuta. The Talang Mamak tribe, or the Tri Hita Karana concept that developed in Bali Province. The Tri Hita Karana

concept is full of the meaning of harmony and balance in the relationship between humans and God, humans and humans, and humans and the environment. Sustainable development is also an elaboration of the values of Pancasila as the foundation of the state which is built on the noble values of the Indonesian culture.

Knowledge of the concept of sustainable development must be taught, disseminated, and socialized to all stakeholders involved in development. Collaboration and shared understanding between policy makers, local governments, business actors and the community itself are important, so that there are no more extensive forest fires for the sake of profit alone, but have an impact on very high social costs. The results of his research stated that collaborative training methods on the concept of sustainable development will increase understanding, shared knowledge, and better understanding of the importance of development while still paying attention to environmental sustainability.

RESEARCH METHODS

The study uses a quantitative approach. The data used are secondary data sourced from the publication of the Central Statistics Agency of Indonesia, the portal of the Ministry of Education and Culture, the Ministry of Law and Human Rights, the Ministry of Finance, and the Ministry of Environment of Indonesia. The unit of analysis is all provinces consisting of 33 provinces in Indonesia with a period of 2011-2020.

This study consists of several composite indices built at the provincial level, namely the Economic Resilience Index (IKE) and the Sustainable Development Index (IPB). Before the formation of the composite index, data normalization is first carried out to obtain the same units. Calculation of data normalization for normal data indicators, where the larger the number indicates a good indicator. The general formula used is as follows.

$$X_{it} = \frac{(X_{it} - X_{\text{minimum}})}{(X_{\text{maksimum}} - X_{\text{minimum}})} \times 100 \quad (1)$$

Meanwhile, for indicators with the opposite direction, such as the Gini Index, Percentage of the Number of Poor People, Open Unemployment Rate (TPT), the following general normalization formula is used.

$$X_{it} = \frac{(X_{\text{maximum}} - X_{it})}{(X_{\text{maximum}} - X_{\text{minimum}})} \times 100 \quad (2)$$

To measure the influence of the knowledge economy and culture on economic resilience, the economic resilience index is first calculated. The economic resilience index (IKE) is formed based on indicators of GRDP per capita, TPAK (Labor Force Participation Rate), TPT (Open Unemployment Rate), Domestic Investment (IDN), Foreign Investment (ILN) and Human Development Index (HDI).

Table 1: Operational Definition of Research Variables

Variable	Data source	Indicators used
Economic Resilience Index	Central Bureau of Statistics	GRDP per capita, TPAK, TPT, Domestic Investment, Foreign

		Investment, Human Development Index
Sustainable Development Index	Central Bureau of Statistics; Ministry of Environment	Economic Growth, TPT, Human Development Index, Gini Index, Percentage of Poor People, Environmental Quality Index
Education	Central Bureau of Statistics	Literacy Rate, School Enrollment Ratio, Average Years of Schooling
Technology	Central Bureau of Statistics	Mobile Phone User Ratio, Internet Access Ratio, Computer Access Ratio
Innovation	Central Bureau of Statistics; Ministry of Law and Human Rights; Ministry of Education and Culture	Intellectual Property Rights, Number of Scientific Publications, Foreign Investment
Institutional	Central Bureau of Statistics	Civil Liberties, Political Rights, Democratic Institutions
Cultural heritage	Cultural Statistics-Ministry of Education and Culture; Central Bureau of Statistics	Object Cultural Heritage, Intangible Cultural Heritage
Cultural Participation	Central Bureau of Statistics	Performance Watching Ratio, Performance Involvement Ratio, Visits to Cultural Places, Traditional Product Usage Ratio
Tourist	Central Bureau of Statistics	GRDP Cultural and Tourism Services, Average Length of Stay of Foreign Tourists, Room Occupancy Rate
Development Fund	Ministry of Finance	Local Original Income, Balancing Funds

Before the index is formed, data is first normalized according to the formulas in equations (1) and (2). Furthermore, modifications are made to equation (3). The formula for formulating the economic resilience index can be written as follows.

$$IKE_i = \sqrt[6]{PDRBi \times TPAKi \times TPTi \times IDNi \times ILNi \times IPMi} \quad (3)$$

Next, a panel data regression estimation model can be written as follows.

$$IKE_{it} = \alpha + \beta_1 PEND_{it} + \beta_2 TECH_{it} + \beta_3 INOV_{it} + \beta_4 KEL_{it} + \beta_5 PAR_{it} + \beta_6 PABIT + \beta_7 TOUR_{it} + \beta_8 FUNDS_{it} + \varepsilon_{it} \quad (4)$$

Where

IKE : economic resilience index of province i in period t
 PEND : education index of province i in period t
 INOV : innovation index of province i in period t

KEL	: civil liberties institutional index of province i in period t
PAR	: cultural tourism index of province i in period t
PAB	: cultural participation index of province i in period t
TOUR	: tourism index of province i in period t
FUNDS	: index of development fund allocation for province i in period t
Dummy	: dummy variable of province code in province i in period t
α	: intercept or average value of the number of people working if the independent variable is removed
$\beta_1 \dots \beta_8$	: coefficient value of each independent variable to be estimated
ε_{it}	: error term

This study also aims to determine the influence of economic resilience, knowledge economy and culture on sustainable development in Indonesia. Using data from 2015-2020. Before the regression estimation is carried out, the calculation for the sustainable development index is first carried out. The sustainable development index (IPB) is formed based on indicators of the environmental quality index (IKLH), economic growth rate (TPE), Open Unemployment Rate (TPT), Human Development Index (HDI), Gini index (GINI), and percentage of poor people (POM). The formula for calculating the sustainable development index can be written as follows.

$$IPB_i = \sqrt[6]{TPE_i \times TPT_i \times IPM_i \times GINI_i \times POM_i \times IKLH_i} \quad (5)$$

Next, a panel data regression estimation model can be written as follows.

$$IPB = \alpha + \beta_1 IP_{it} + \beta_2 IB-P_{it} + \beta_3 Dummy_{it} + \varepsilon_{it} \quad (6)$$

Where

IPB	: sustainable development index of province i in period t
IP_{it}	: knowledge economy index of province i in period t
IB-P	: economic and cultural tourism index of province i in period t
Dummy	: dummy variable of province code in province i in period t
α	: intercept or average value of the number of people working if the independent variable is removed
$\beta_1 \dots \beta_3$	: the coefficient value of each independent variable to be estimated
ε_{it}	: error term.

Regression estimation analysis is also conducted to see the effect of economic resilience (IKE) on sustainable development (IPB) at the provincial level. The regression estimation equation can be written as follows.

$$IPB = \alpha + \beta_1 IKE_{it} + Dummy_{it} + \varepsilon_{it}$$

Where

IPB	: sustainable development index of province i in period t
IKE_{it}	: knowledge economy index of province i in period t

t	Dummy	: dummy variable of province code in province i in period t
α		: intercept or average value of the number of people working if the independent variable is removed
β_1		: the coefficient value of the independent variable to be estimated
ε_{it}		: error term.

RESULTS AND DISCUSSION

Table 2 is a summary of the best model test and heteroscedasticity test of each panel data regression result used. Based on the results of the Hausman test where $H_0 = RE$ and $H_1 = FE$, the results obtained are that the $\text{Prob} > \chi^2 = 0.0000$ test value, which means that the best model uses *Fixed Effect*. Furthermore, based on the Wald-heteroscedasticity test, it turns out that the model *Fixed Effect* There is a heteroscedasticity problem. Therefore, the best model used in this study uses the model *Generalized Least Square* (GLS) which is able to overcome the problems of heteroscedasticity and autocorrelation. While for all models there is no multicollinearity because it uses the *pca* technique. From the variance inflation factor (VIF) value it is also proven that the Mean VIF value is $3.41 < 10$.

Table 2: Summary of Best Model Selection Test

Model	Best Model Selection Test Results
<i>Ordinary Least Square</i> (OLS)	The OLS model in this study was ignored because of the assumptions of constant slope and intercept.
<i>Random Effect Model</i> (REM)	Based on the Hausman test, the $\text{Prob} > \chi^2 = 0.0000$ model value, $H_0 = RE$ is rejected, so the best model uses the Fixed Effect Model.
<i>Fixed Effect Model</i> (FEM)	The results of the Wald test show that there are symptoms of heteroscedasticity so that the regression results will cause bias. Wooldridge test for autocorrelation in panel data; H_0 : no first order autocorrelation; $F(1, 32) = 7.584$; $\text{Prob} > F = 0.0096$ Mean VIF = 3.41 Modified Wald test for groupwise heteroskedasticity in fixed effects regression model; H_0 : $\sigma(i)^2 = \sigma^2$ for all i ; $\chi^2(33) = 5679.80$ $\text{Prob} > \chi^2 = 0.0000$
<i>Generalized Least Square</i> (GLS)	The GLS regression estimation results do not show symptoms of heteroscedasticity and serial correlation. Coefficients: generalized least squares Panels : homoscedastic Correlation: no autocorrelation

After obtaining a model free from heteroscedasticity, serial correlation and multicollinearity problems, the next step is to conduct GLS regression. From the results of GLS regression in Table 3, it can be seen that there are three variables of

knowledge economy, namely: education, technology, and innovation, which have a positive and significant effect on economic resilience. Institutions have a negative effect. Meanwhile, the cultural economy through tourism transmission shows the same results, namely a positive and significant effect on economic resilience.

Table 3: Summary of GLS Regression Results of Knowledge Economy and Cultural-Tourism Economy on Economic Resilience

Economic Resilience (IKE)	Coef	Std. Err	z	P> z 	[95% Conf.]	[Intervals]
Education	5,040***	.854	5.90	0.000	3.365	6,715
Technology	.615*	.317	1.94	0.053	-.006	1.237
Innovation	1,728***	.450	3.84	0.000	.845	2.612
Institutional	-.180	.278	-0.65	0.517	-.725	.365
Cultural heritage	-.475	.370	-1.29	0.199	-1.201	.249
Cultural Participation	-1.016**	.421	-2.41	0.016	-1,842	-.190
Tourist	1,714***	.423	4.05	0.000	.884	2,544
Allocation of Development Funds	-.706	.525	-1.35	0.178	-1,736	.322
_cons	5,619	1,531	3.67	0.000	2.616	8,621
*** p<0.01, ** p<0.05, * p<0.1						

Furthermore, if partial regression estimation is carried out, each for the knowledge economy and cultural-tourism economy variables, the results can be seen in Table 4 below.

Table 4: Summary of GLS Regression Results of Knowledge and Culture Partially on Economic Resilience

Economic Resilience	Coef	Std. Err	z	P> z 	[95% Conf.]	[Intervals]
Knowledge Economy						
Education	3.443***	.764	4.50	0.000	1,944	4.942
Technology	.559*	.310	1.80	0.072	-.050	1.168
Innovation	1.288***	.312	4.12	0.000	.675	1,901
Institutional	-.077	.283	-0.27	0.784	-.632	.477
Cultural Economy-Tourism						
Cultural heritage	.943**	.359	2.62	0.009	.237	1,648
Cultural Participation	1,382***	.368	3.75	0.000	.660	2.104
Tourist	1,822***	.462	3.94	0.000	.915	2,728

_cons	1,088,406	1,104,415	9.86	0.000	8,719	1,304
*** p<0.01, ** p<0.05, * p<0.1						

Based on the partial regression results, it shows that all variables have a positive and significant effect on economic resilience, except for democratic-political institutions. Education has a very strong influence when compared to other variables. Education is the main source of knowledge. Education is an important factor that can make someone have skills and knowledge according to their field. The higher the individual's education, the higher their income. Many studies state that investment in education and training in the long term increases labor productivity, provides higher income and quality of life, in turn is able to increase family economic resilience and in aggregate increase national economic resilience.

Algan et al (2021) stated that higher levels of education can increase economic resilience in both the short and medium term. The results of Howard et al's (2021) study stated that investment in education at the university level can increase local economic resilience. Meanwhile, Simões et al (2022) from their research results concluded that workers with higher levels of education have a higher level of resilience and are protected from the threat of termination of employment when economic shocks and disruptions occur.

The development of technological infrastructure is very important for Indonesia as an archipelagic country. Indonesia has built the Palapa Ring as a network infrastructure so that people throughout Indonesia can access the internet evenly. The KOMINFO Annual Report (2021) states that Base Transceiver Stations (BTS) have been built in 1,682 villages and sub-districts throughout Indonesia to serve Information and Communication Technology (ICT) services to remote communities, especially in the outermost, most remote, and disadvantaged areas which are part of a total of more than 550,000 BTS spread throughout Indonesia.

The process of regional and rural development cannot be separated from and requires the role of technology. The use of the internet, computers and smartphones is a supporting force for rural communities to be able to access information and make real contributions to development. Provision of ICT infrastructure and easy access to information through ICT alone is not enough, it needs to be supported by human resources who are able to master and have sufficient knowledge of technology. Mastery of technology will increase economic resilience both regionally and nationally.

Innovation capability, especially technological innovation capability, is the ability to provide new ways to overcome sudden disruptions and shocks. The Covid-19 pandemic has changed the way of life and transaction models from offline to online. Innovation in learning systems, working from home, and online transactions are solutions carried out during the Covid-19 pandemic due to social restrictions and community activities. Bristow & Healy (2017) proved in their research that there is a strong relationship between innovation and economic resilience. Innovation is not only about technological innovation, but the overall capacity of innovation including the behavior and perspectives of society and companies. Wang et al. (2021) concluded in their research that to increase regional economic resilience, policy makers must be

able to encourage innovation and entrepreneurial behavior through the regulations and policies made.

Political-democratic institutions have not been able to strengthen economic resilience. Indonesia has continuously, although slowly, improved the quality of political democracy in Indonesia. Keppel (2022) used democracy indicators in his research, and stated that to strengthen the quality of democracy, political control over parliament is needed through knowledge of politics. Kabir & Alam (2021) found that the quality of democracy has a significant effect on a country's economic growth. Political development and the quality of democracy in Indonesia have always experienced ups and downs. Since the fall of the New Order regime in 1998, Indonesia has entered an era of better democracy (Aminuddin & Purnomo, 2019). However, in the reform era, there was political chaos during the 2014 general election and its impact is still felt today.

Cultural heritage and cultural participation as cultural capital do not directly affect the economic resilience of a region, but through its appeal which is then able to attract foreign tourists to visit. From the results of the regression, the tourism variable has a positive and significant effect on economic resilience. The tourism sector is an economic sector that has a high level of resilience. The tourism sector is able to provide foreign exchange and contribute to Gross Domestic Product, as well as provide employment opportunities. The development of tourist visits from various countries continues to increase until 2019. The economic shock that occurred in 1998, due to the monetary crisis, caused a decrease in foreign tourist visits by 11.18 percent, then slowly increased two-fold in 2019.

On the other hand, the use of development fund allocation has not been effectively and efficiently utilized. The relevant ministries continue to make improvements and redesign the planning and budgeting system to be more performance-based. In addition, bureaucratic reform was carried out by shifting structural positions to functional positions. The goal is for the bureaucracy to be more agile in managing development funds in order to implement development programs in each region.

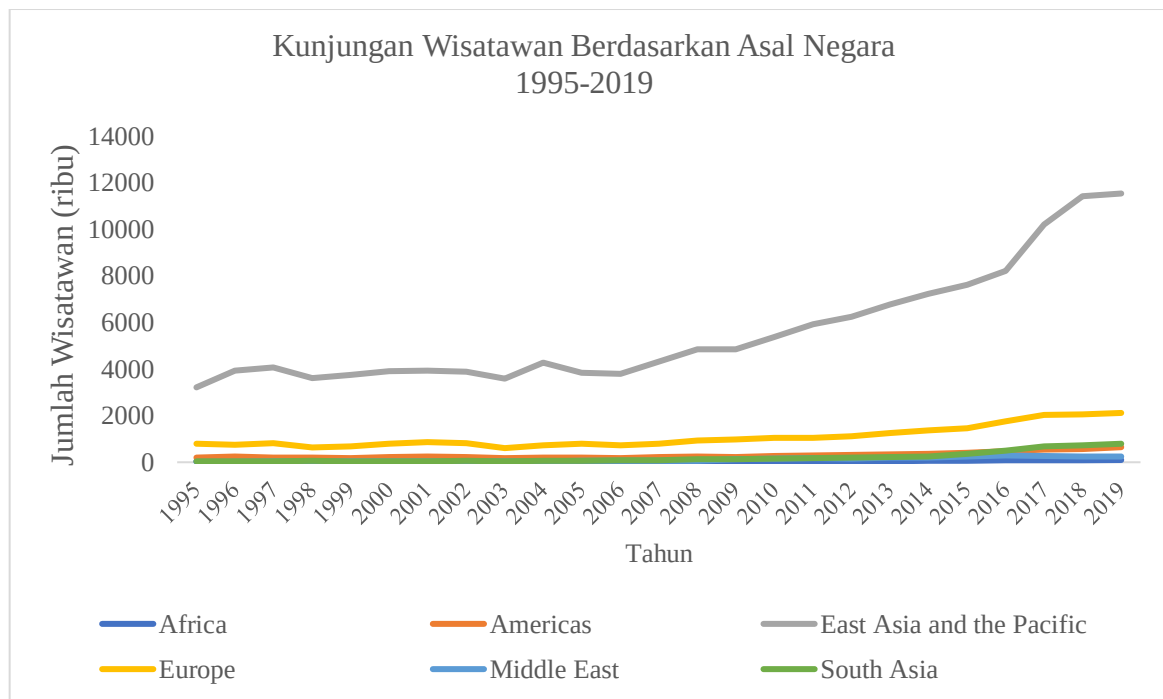


Figure 2: Tourist Visits by Country of Origin 1995-2019

Sustainable Development of Provinces in Indonesia

Based on the regression results between IPB and IP and IB-P, it shows that the Knowledge Index and Culture-Tourism Index have a positive and significant influence on sustainable development in Indonesia.

Table 5: Regression Results of IP and IB-P against IPB

IPB	Coef	Std. Err	z	P> z	[95% Conf.	intervals]
Knowledge Economy						
IP	.384	.094***	4.07	0.000	.199	.570
IB-P	.826	.204***	4.05	0.000	.426	1.226
Constant	.384	.094	4.07	0.000	.199	.570

*** p<0.01, **p<0.05, *p<0.1

The variables of the knowledge economy are the engines of economic growth. Meanwhile, from the perspective of cultural economy, development does not only pursue economic growth, but must also pay attention to the environment. Development is not only for the present, but is able to provide continuity of development results that can be enjoyed by the next generation.

Sustainable development requires sustainable economic resilience. Sustainable economic resilience through technology and innovation will enable sustainable development to continue and overcome shocks that will always arise in the economic cycle. The results of the regression between economic resilience (IKE) and sustainable development (IPB) in Table 6 prove that economic resilience can provide a positive and significant influence on sustainable development.

Table 6: Results of IKE Regression against IPB

IPB	Coef	Std. Err	z	P> z	[95% Conf.	intervals]
Knowledge Economy						
IKE	.830***	.175	4.73	0.000	.486	1.174
Constant	4.205	3.276	12.84	0.000	3,563	4,847

*** p<0.01, **p<0.05, *p<0.1

Knowledge, culture, economic resilience and sustainable development are interrelated. With knowledge, economic resilience can be increased. Shocks and disruptions are unexpected and unavoidable events. Anticipation and planning for rapid and appropriate recovery from shocks are absolute. And this can be done through knowledge. Meanwhile, culture, in addition to providing economic resilience value, is also able to support sustainable development programs. Local wisdom is knowledge *tacit* which teaches development values while still paying attention to environmental balance. The role of policy is very important so that development does not only exploit natural resources, but needs to be carried out with knowledge and culture-based policies.

Figure 3 shows the index values for IP, IB-P, IKE and IPB of provinces in Indonesia. The relationship pattern between each index score for each province shows that development in each region is not the same, depending on several factors, such as natural environmental factors, economic, social and cultural factors. Provinces on the island of Java are centers of economic, knowledge and cultural activities have high IP and IB-P, but IPB is lower compared to other provinces in Indonesia, this is usually caused by poor Environmental Quality Index, and vice versa.

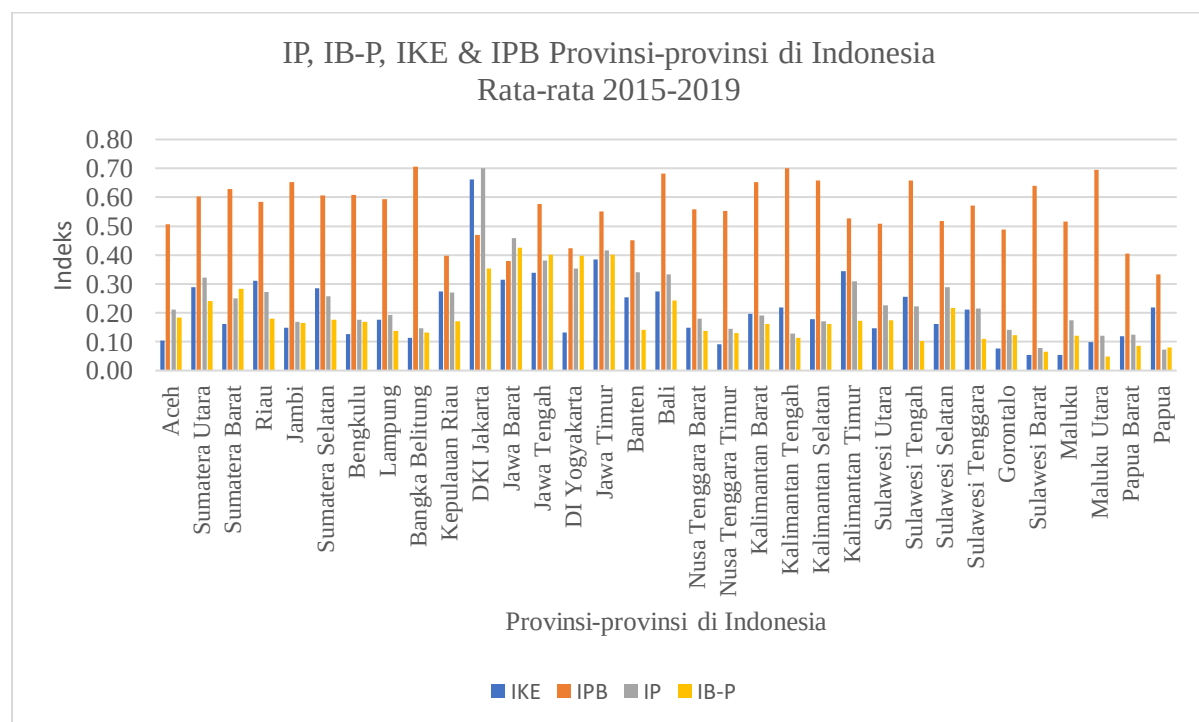


Figure 3: IP, IB-P, IKE, and IPB of Provinces in Indonesia, Average 2015-2019

Based on the relationship between these index numbers for each province, balance and equitable development are needed. The plan to move the provincial

capital of DKI Jakarta to East Kalimantan is one form of effort to achieve balanced development. The environmental carrying capacity in DKI Jakarta province is estimated that in the next few years it will no longer be able to support development. On the contrary, it is necessary to equalize knowledge by improving the education, technology and innovation sectors in provinces that are still low, so that it is hoped that in turn it will be able to increase economic growth, have the resilience needed to be able to continue the regional sustainable development program that supports sustainable development goals at the national level.

CONCLUSION

The results of the study prove that education, technology and innovation have a positive and significant effect on economic resilience. Technology has proven to be able to answer the challenges of shocks during the Covid-19 pandemic in Indonesia. Innovation is a new breakthrough, a new way, a new discovery that is able to answer the challenges of shocks. The role of democratic-political institutions is still unable and has not had a real effect as a determinant of economic resilience, as well as the allocation of development funds has not been used effectively and efficiently. The causes and types of shocks that arise have different impacts on the cultural economy sector. The shock due to Covid-19 has caused the implementation of social distancing regulations to create a high level of vulnerability to bad impacts, especially in the tourism sector. The role of technology and innovation is very important and can be one of the right alternative solutions.

The role of knowledge and culture is important because it can support sustainable economic resilience and at the same time encourage the achievement of sustainable development goals. In Indonesian culture, there is a lot of local wisdom that teaches how development is carried out without sacrificing the environment, maintaining a balance of development based on humanitarian, environmental, social, cultural aspects, including health. This research is expected to provide input and contributions of ideas about the importance of knowledge and culture for economic resilience that can support sustainable development programs in Indonesia.

For further research related to knowledge and culture can be done by using primary data with a case study approach. Knowledge is a sustainable science because it continues to develop and is able to answer the problems and challenges of the times. While from a cultural perspective, it provides inspiration for development that not only pursues economic growth, but also balance with the environment.

SUGGESTION

The discussion related to this research is still very limited and requires a lot of input, suggestions for future authors are to study more deeply and comprehensively the influence of knowledge economy and culture on economic resilience and sustainable development in Indonesia.

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