



Knowledge and Culture-Based Development Policy Scenarios Using the PROMETHEE Method

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Permalink/DOI: <https://doi.org/10.15294/jejak.v17i1.5613>

Received: November 2023; Accepted: February 2024; Published: April 2024

Abstract

Knowledge and culture-based development is carried out by relying on knowledge and cultural resources as development capital. Development policy scenarios are needed to carry out development programs. Some of the development programs outlined in the national development plan are strengthening economic resilience for quality and equitable growth, reducing income inequality and alleviating poverty, as well as increasing competitiveness. The purpose of this study is to determine the priority scale based on economic development policy scenarios on the basis of knowledge and cultural resources in Indonesia. The research method is MCDA decision analysis (Multi-Criteria Decision Analysis) with the PROMETHEE method (Preference Ranking Organization Method for Enrichment Evaluation). PROMETHEE is a sequencing method based on a binary relationship between two or more alternatives. Meanwhile, to calculate the score of each program and development objectives, the primary component analysis technique is used. The data used is secondary data which is mostly sourced from the Central Bureau of Statistics. The results of the research show that the knowledge and culture-based development scenarios based on the sequence are as follows. First, strengthening economic resilience and increasing GRDP per capita. Second, increasing competitiveness, and third is reducing income inequality and the number of the poor.

Key words : knowledge, culture, *Multi-Criteria Decision Analysis*, PROMETHEE

How to Cite: Nizar, N. I. (2024). Knowledge and Culture-Based Development Policy Scenarios Using the PROMETHEE Method. *JEJAK*, 17(1). doi:<https://doi.org/10.15294/jejak.v17i1.5613>

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INTRODUCTION

Knowledge and culture-based development is an alternative approach in dealing with development challenges and problems. Based on the 2022 national development work plan, the priority for development policy is economic resilience for quality and equitable growth. On the other hand, poverty and income inequality are issues that must be overcome. Indonesia is currently

carrying out economic recovery due to COVID-19. After recovery, it is expected that national and regional economic development will return to a better economic growth path. The summary book Vision of Indonesia in 2045 (Bappenas, 2019) states that competitiveness is needed in order to be able to compete with other countries which in turn can achieve the vision of development, to become a developed country in 2045.

National or regional development policies should not only be oriented towards the utilization of natural resources or monetary and fiscal issues, but also need to pay attention to knowledge and cultural resources as development capital. Jadranka & Marina (2017) state that knowledge resources are a Knowledge economy concept that is rooted in information theory to post-industrial theory. Modern economic theory (Korres, 2018), has included a component of the knowledge economy with two main components, namely the learning process and technological change into a new growth model. The process of learning and investing in education is then known as the concept of human capital. Furthermore, several international organizations have developed knowledge-based economic frameworks to help measure the knowledge economy's contribution to a country's development.

Throsby (2020), a cultural economist, introduces the concept of cultural capital, which is an asset that can provide cultural and economic value. This concept is different from Bourdieu's concept of cultural capital (Coulangeon & Duval, 2015). According to Bordieu, cultural capital is a high culture that is attached or owned by someone. High culture can be in the form of a high level of education, possessing cultural objects of high value and possessing high artistic skills. One form of cultural capital is cultural heritage. UNESCO builds a cultural economic framework into the cultural domain and the domain related to culture (Sung, 2014). Tourism is one of the domains related to the cultural domain. One of the relationships between culture and development performance is from cultural attraction through tourism.

The cultural economy is broader than the creative economy, not only about products or production results but also related to cultural events, events and activities such as cultural festivals, cultural exhibitions, inclu-

ding the tourism industry. Greffe (2016) states that cultural activities are able to provide ideas and creativity as well as inspiration to encourage the development of the creative economy industrial sector. The cultural economy takes into account the value of cultural heritage as a component of the cultural economy (Keser, 2016). Furthermore, cultural values influence economic development.

Economic resilience is one of the development program policy priorities needed at this time. This economic resilience is needed to deal with disturbances and shocks in the economic cycle. When the Covid-19 pandemic was not over, a new threat emerged, namely climate change to the Russo-Ukrainian war which had triggered food and energy crises. In the end, global economic conditions worsened. The inflation rate rose sharply to its highest point, and several countries were even declared bankrupt because they were unable to repay debts. According to Sutton & Arku (2022) there are seven types of disturbances, namely: economic, institutional, organizational, environmental disturbances, human actions, technological disruptions and epidemics.

There are at least two schools of thought regarding the concept of economic resilience. The first is the economic approach. Some writings related to resilience with an economic approach are Rose & Krausmann (2013) and Hallegatte (2014). The view of economic resilience with an economic approach states that economic resilience is a dynamic condition, the ability to reconstruct, recover and then return to a new balance. Second, is an evolutionary approach (Boschma, 2015; Martin & Sunley, 2015). Economic resilience in an evolutionary perspective assumes that economic resilience is a process of adaptive changes to economic structures, social, and institutional arrangements to maintain and restore returns to previous growth paths, or to new growth paths.

Indonesia first announced a corona case in March 2020. The occurrence of this pandemic had an impact on economic activity, one of which was disruption and shock due to restrictions

on economic activity. Based on the Indonesian Central Bureau of Statistics, economic growth experienced a contraction and negative economic growth in 2020 of -2.07%. The growth rate of Gross Domestic Product by business field after the first quarter and throughout 2020 showed that almost all business fields were experiencing a negative growth rate. Meanwhile, several business sectors, such as agriculture, information and communication, education services, demonstrated relatively good economic resilience during the Covid-19 pandemic. On the other hand, seen from the rate of household aggregate consumption in the fourth quarter, it contracted to -3.6% in 2020. The biggest contribution to economic growth in Indonesia was household aggregate consumption. Disrupted aggregate consumption resulted in disruption to economic growth.

Income inequality and poverty are fundamental development problems faced by many developing countries. One of the most widely used measurement tools for income distribution inequality is the Gini coefficient. The Gini coefficient has a score between 0 and 1. A value of 0 indicates that there is no perfect income inequality, while a value of 1 indicates that there is perfect income inequality. Poverty is calculated based on the poverty line. Household income below the poverty line is included in the poor group. The definition of the poverty line reaps a lot of debate (Booth, 2019) because there are many definitions and measures used in calculating the poverty line.

In Indonesia itself, the measurement of poverty and income inequality is carried out by the Central Bureau of Statistics. The concept used to measure poverty is based on meeting basic needs (basic needs approach) for food and non-food which is measured according to the poverty line. Residents are said to be poor if the average expenditure per capita is below the poverty line which reflects the

minimum expenditure needed to meet the basic needs of life for a month, both food and non-food needs.

Meanwhile, to measure income inequality, the Gini coefficient, Theil index, L index and World Bank measure are used. The Gini ratio is a measure of the level of income inequality that is widely used in various countries. A change in the Gini ratio is an indication of a change in the distribution of population spending. The World Bank's criteria divide the population into three major sections, namely the bottom 40%, the middle 40% and the top 20%. The level of inequality in population spending according to World Bank criteria is centered on the 40% of the population with the lowest spending.

One of the main causes of income inequality is education. Research by Mahmud & Akita (2018) in Bangladesh states that education inequality between urban and rural areas results in income disparities between urban and rural residents. Arched et al. (2019) confirm Kuznetz's well-known hypothesis, that in the early stages of development, income inequality will first rise and then fall as economic growth increases and is more developed due to trickle-down development. McKnight (2019) tries to review several studies related to the relationship between inequality and economic growth. Some studies show ambiguous results, because they show inconsistent results. The relationship between inequality and economic growth is non-linear. The idea of Kuznet's hypothesis leads to a broader relationship, such as the relationship between inequality, poverty and economic growth, or known as the poverty-growth-inequality-poverty triangle (Poverty-Growth-Inequality Triangle).

Policies to solve the problem of income inequality and poverty have continued to be implemented until now. Sustainable programs and policies from the government are able to reduce the Gini coefficient and the percentage of poor people. The Central Statistics Agency noted that there was a decrease in income inequality

from the Gini figure of 0.411 in 2011, down to 0.380 in 2019. The percentage of poor people also decreased from 12.49% in 2011 to 9.41 % in 2019. But then income inequality and the number of poor people tend to rise again as a result of the Covid-19 pandemic.

In addition to facing development problems and challenges, development programs should also have an orientation to increase GRDP per capita as well. GRDP per capita apart from being part of economic resilience, is also a development goal and program that is continuously being improved. On the other hand, to achieve development goals that are advanced, just and prosperous, it requires the ability of the nation to have high competitiveness in facing the challenges of globalization by utilizing the resources it has, both in the form of natural resources, as well as knowledge and cultural resources.

Knowledge and culture-based development policies are built on the framework of the knowledge economy and cultural economy. The knowledge economy framework issued by the World Bank consists of four pillars (Dima, et al, 2018), they are education, technology, innovation, and economic institutions. Choong & Leung (2021) divides the evolution of the concept of the knowledge economy into two waves of thought, namely thoughts on the knowledge economy and knowledge management. The development of thought in the first stage emphasizes the importance of the knowledge aspect in policy making; how knowledge is used to create an education industry, encourage the creation of a society that relies on information and knowledge in creating jobs and driving economic growth as well as having an impact on economic activity broadly. The second wave of knowledge economy thinking is more focused on the creation, role and implementation of the sciences of management, organization, business and innovation. In this era known as the concept of knowledge management.

Research by Barkhordari et al (2019) states that education, technological infrastructure, innovation systems and economic institutions are the pillars of a knowledge-based economy that have a significant and positive effect on development and economic growth. Several other research results (Amirat & Zaidi, 2020; Nurunnabi, 2017; Parcerro & Ryan, 2017) are of the same opinion that the knowledge economy plays a key role in economic development. Several studies related to the knowledge economy and poverty were written by Shahabadi et. al. (2017) concludes that the knowledge economy is able to reduce income inequality. Martin (2019) states that the role of higher education institutions in regional development can reduce income inequality and poverty through the transfer of knowledge. With the improvement of a person's level of education, income will increase and in turn will reduce income inequality and poverty.

This research uses the three pillars of the knowledge economy, they are education, technology, and innovation. Meanwhile, the fourth pillar is political-democratic institutions. Democratic institutional factors determine the success of a development. Keppel (2021) uses indicators of democracy in his research, and states 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 developments and the quality of Indonesian democracy always experience ups and downs. Since the fall of the *Orba* government regime in 1998, the reform era despite the political frenzy during the 2014 general election, Indonesia has entered a better era of democracy (Aminuddin & Purnomo, 2019).

Meanwhile, the cultural economy pillar refers to the 1999 UNESCO framework (Sung, 2014), namely cultural heritage and cultural participation. The relationship between culture and development is not direct, but through a transmission process. One of the entry points for

cultural transmission to development is through tourism. Cultural values in the form of cultural heritage, arts, cultural festivals, traditions, cultural experiences have a close relationship with the tourism industry. Cultural heritage is an important and widely recognized driver of sustainable development, but its role has remained marginal in past and present international development agendas (Gilberto & Labadi, 2022). Cultural heritage can directly contribute to poverty alleviation (Rosetti, et al., 2022). Research by Dobrosława Wiktor-Mach (2019) states that there has been a paradigm shift regarding the relationship between cultural heritage and development. Cultural heritage is not just a legacy that has high cultural value but also has a real role in development. In this case, the role of cultural governance becomes very essential.

Hristova et. al. (2018) states that culturally attractive cities tend to invite people to visit and generate results for the economy. Other research related to the relationship between culture and development was conducted by Zakharov et. al (2020), using the transmission of social capital, namely trust and calculating the effect on GDP per capita. The results of the study show that there is a strong relationship between trust and GDP per capita. Behaviour and attitude of trust make a significant contribution to GDP per Capita. Previous similar research was conducted by Maridal (2013) who concluded that culture through trustworthiness, honesty, has a positive effect on a country's economic growth. Culture has an important role in the development of knowledge. Mokyr (2017) mentions that culture has been able to turn the dark ages in Europe into a period of enlightenment and ultimately lead to the industrial revolution.

Knowledge and culture have a close relationship. In Indonesian culture, there is a term of *local wisdom* (*kearifan lokal*). Kno-

wledge creation can be divided into two dimensions; they are explicit knowledge and tacit knowledge (Borges, et al, 2018). Explicit knowledge is knowledge that is taught formally, while tacit knowledge is knowledge based on experience. Local wisdom is tacit knowledge that is passed down from generation to generation in certain communities. According to Pesurnay (2018), local wisdom contains a value system and Knowledge system that supports the continued 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 construction of traditional houses that describe earthquake mitigation. Sumardi & Wahyudiati's research (2021) concluded that local wisdom can be a solution to help overcome the impact of disruption due to Covid-19. Local wisdom is a form of non-object cultural heritage registered with the Indonesian Ministry of Education and Culture.

Based on the description and theory of development problems, as well as several research references related to knowledge and culture-based development above, the purpose of this study consists of two points. The first is to find out the priorities and effectiveness of policies on knowledge and culture-based development models based on development goals and programs. Second is to find out the priorities and effectiveness of policies at the provincial level in Indonesia. In development plans there are always policy priorities, whether strengthening economic resilience, increasing and equalizing GRDP per capita, increasing competitiveness, or reducing income inequality and poverty. At a time when the economic recovery and the anticipation of the energy and food crisis are being carried out, as well as the global economic conditions that are still uncertain, the development priority is to strengthen economic resilience for quality and equitable growth. By using PROMETHEE, we will study the outranking or priority order of knowledge- and culture-based develop-

ment policies based on development programs and outranking policies at the provincial level in Indonesia.

METHOD

To analyse development policy scenarios based on the knowledge economy and culture, the MCDA (Multi-Criteria Decision Analysis) method is used with the PROMETHEE software (Preference Ranking Organization Method for Enrichment Evaluation). Some researchers used this method, such as Fitriana (2019) who formulated an inclusive development model for the creative economy of West Sumatra, Ariyani et al., (2016) regarding the policy scenario model for poverty alleviation programs in Indonesia and Batubara et al., (2016) examining the decision process on the sustainable development of oil and gas resources in Natuna.

PROMETHEE I (partial ranking) and PROMETHEE II (complete ranking) were first developed by Brans in 1982, then continued to be developed to produce PROMETHEE VI (Fauzi, 2019). PROMETHEE is an outranking method based on a binary relationship between two or several alternatives (Fauzi, 2019). The ordering relationship is referred to as the preference index or $\pi(a, b)$. The preference index between choices a relative to b can be defined as the weighted average of the preference functions of different types. The mathematical equation can be written as follows.

$$\pi(a, b) = \frac{\sum^k w_i P(a, b)}{\sum_i w_i} \quad (1)$$

$P(a, b)$ is the alternative preference function between a and b. After determining the preference ranking is calculated, then the calculated value is called the outgoing flow (ϕ^+) and incoming flow (ϕ^-), and the difference between the two is known as net flow (ϕ_n). The equation can be written as follows.

$$\begin{aligned} \phi^+(a) &= \frac{1}{n-1} \sum_{x \in A} \pi(a, x) \\ \phi^-(a) &= \frac{1}{n-1} \sum_{x \in A} \pi(x, a) \\ \text{Net flow} &= \phi_n = \phi^+(a) - \phi^-(a) \end{aligned} \quad (2)$$

In this research, there are two evaluation of policy scenarios that are analyzed. The first is a development policy scenario based on the knowledge economy and culture related to priorities (ranking) and the effectiveness of development program policy scenarios, namely: reducing income inequality, alleviating poverty, increasing GRDP per capita, strengthening economic resilience, and strengthening competitiveness. Economic resilience is calculated in the form of an index using data based on economic indicators, namely: GRDP per capita, Labor Force Participation Rate (TPAK), Open Unemployment Rate (TPT), Domestic Investment, Foreign Investment and Human Development Index (IPM). The same thing was done for the Competitiveness Index, compiled based on the indicators of Information Communication Technology Development Index (IP-TIK), HDI, energy, security, and health. Second, the policy scenario is based on knowledge and culture-based development outranking at the provincial level in Indonesia. Based on the net flow score calculated by PROMETHEE, it can be identified which provinces are the strongest in implementing knowledge and culture-based policies in Indonesia.

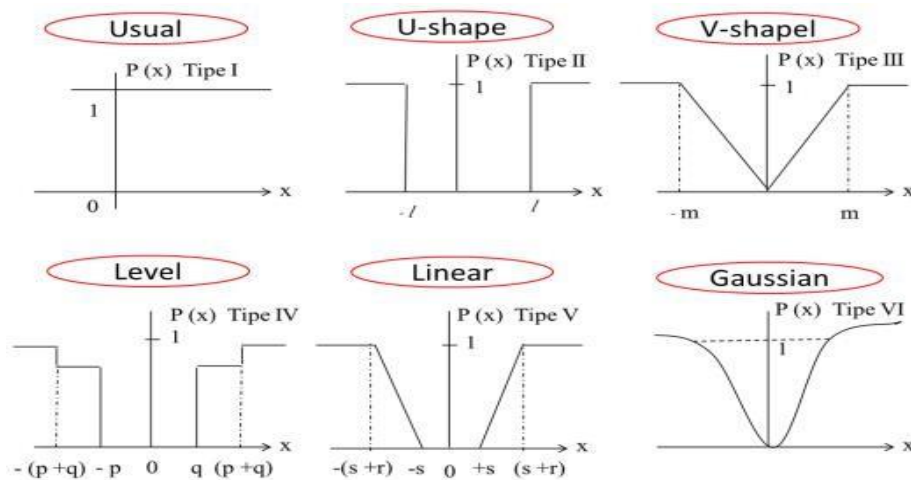


Figure 1. Six Types of Function Preferences

Source: Adopted from Rahma (2022), PROMETHEE Training Materials

By using PROMETHEE, it is possible to determine the net flow value to determine the order of priorities and the effectiveness of the strategy and policy model for knowledge and culture-based economic development. The preference function in PROMETHEE uses Type V - Linear which is a form of quantitative criteria, because all the data used is quantitative data. In PROMETHEE there are six types of criteria, namely: Usual, Quasi (U-shape), V-shape, Step Function, Linear, Gaussian (Fauzi, 2019) as shown in Figure 1 above.

Measurement using PROMETHEE analysis uses a data matrix called criteria and evaluation or action. Criteria are the attributes associated with each action that allow comparisons to be made between actions and determine the best one. While evaluation or action is the object of decision making or the object to be evaluated. The action component is the development program mentioned above and which will be evaluated. While the criteria used are data on the knowledge economy and cultural economy. Calculation of the value of the matrix between actions and criteria using the primary component analysis technique is then taken the highest score. This research uses a quantitative approach. The data used is secondary data sourced from publications

from the Central Bureau of Statistics, the portals of the Ministry of Education and Culture, the Ministry of Law and Human Rights, and the Indonesian Ministry of Finance. The unit of analysis is all provinces consisting of 33 provinces in Indonesia for the period 2016-2020.

Meanwhile, for evaluation by province, the value of the matrix between actions and criteria is the average value of the index formation of the knowledge economy and culture variables of the provinces in Indonesia. Knowledge economy variables consist of education, technology, innovation, and democratic institutions. Cultural economic data consists of cultural heritage and cultural participation. Tourism is used as an entry point for the transmission of cultural attractiveness, while the allocation of development funds is needed as economic capital for development. Prior to forming the index of knowledge and culture economic variables, tourism, allocation of development funds, and other variables to be evaluated, data normalization was carried out first in order to obtain the same size. Thus all the values of these variables have a maximum preference value, including the value of the Gini index and the percentage of the number of poor people. Table 1 is the variables and indicators used to obtain scores using PROMETHEE in order to

determine the outranking of development policies based on knowledge and culture in Indonesia.

Table 1. Indicators used for Measurement with PROMETHEE

Indicators used	(Criteria/Evaluation) Name	Min/Max	Preference
Literacy Rate, School Enrollment ratio, Average Length of School	Criteria - Education	Max	Linear
Smartphone User ratio, Internet Access Ratio, Computer Access Ratio	Criteria - Technology	Max	Linear
Intellectual Property Rights, Number of Scientific Publications, Foreign Investment	Criteria - Innovation	Max	Linear
Civil Liberties, Political Rights, Institutional Democracy	Criteria – Democratic Institutional	Max	Linear
Tangible Cultural Heritage, Intangible Cultural Heritage	Criteria – Cultural Heritage	Max	Linear
The Ratio of Attending Shows, Ratio of Involvement in Shows, Visits to Cultural Places, Ratio of the Use of Traditional Products, Ratio of Participation in Traditional Ceremonies	Criteria – Cultural Participation	Max	Linear
GRDP of Cultural and Tourism Services, Average length of stay of foreign tourists, Room Occupancy Rate	Criteria – Tourism	Max	Linear
Regional Original Revenue, Central-Regional Fiscal Balance	Criteria - Allocation of development funds	Max	Linear
GRDP per capita	Evaluation – GRDP per capita	Max	Linear
GINI Index	Evaluation – Income Inequality	Max	Linear
Percentage of Number of Poor People	Evaluation - Poverty	Max	Linear
Economic Resilience Index	Evaluation – Economic Resilience	Max	Linear
Competitiveness Index	Evaluation - Competitiveness	Max	Linear

Source: BPS, Ministry of Education and Culture, Ministry of Finance, Ministry of Law and Human Rights, 2016-2020, processed

RESULTS AND DISCUSSION

Figure 2 presents the score matrix calculated between the criteria and the development program to be evaluated. There are eight criteria which are indicators of the knowledge economy and culture coupled with the criteria for tourism and allocation of development funds, namely: education, technology, innovation, democratic institutions, cultural heritage, cultural participation, tourism and allocation of development funds. The deve-

lopment programs that will be evaluated are income inequality, poverty, economic resilience, GRDP per capita, and competitiveness. All preference values have a maximum value, including the Gini index and the percentage of poor people as previously, data normalization was carried out according to the explanation in the research method section above.

	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	All	Education	Technology	Innovation	Democratic i...	Cultural Heri...	Cultural Parti...	Tourism	Allocation of ...
Unit	unit	unit	unit	unit	unit	unit	unit	unit	unit
Cluster/Group									
Preferences									
Min/Max	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Weight	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Preference Fn.	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Thresholds	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
- Q: Indifference	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
- P: Preference	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
- S: Gaussian	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Statistics									
Minimum	1622,00	3560,00	6708,00	2612,00	3345,00	1612,00	2155,00	6356,00	
Maximum	3190,00	4792,00	7473,00	3587,00	4822,00	3139,00	3609,00	7438,00	
Average	2701,20	4236,40	7134,20	3047,00	4409,00	2114,60	3073,80	6842,60	
Standard Dev.	583,56	549,65	327,32	443,16	537,79	550,96	485,77	492,49	
Evaluations									
<input checked="" type="checkbox"/> Income Inequality		(all)	(all)	(all)	(all)	(all)	(all)	(all)	(all)
<input checked="" type="checkbox"/> Poverty		(all)	(all)	(all)	(all)	(all)	(all)	(all)	(all)
<input checked="" type="checkbox"/> Economic Resilience		(all)	(all)	(all)	(all)	(all)	(all)	(all)	(all)
<input checked="" type="checkbox"/> GRDP per capita		(all)	(all)	(all)	(all)	(all)	(all)	(all)	(all)
<input checked="" type="checkbox"/> Competitiveness		(all)	(all)	(all)	(all)	(all)	(all)	(all)	(all)

Figure 2. Results of Calculation of Criteria scores matrix and Development Program Evaluationa

The five evaluation scenarios selected are relevant to the Long Term Development Goals (PJP) for 2005 – 2025 and to current conditions, related to the Covid-19 Pandemic. First, income inequality and poverty are still major issues. Poverty is still an important concern in long-term development. The breadth of the territory and the variety of socio-cultural conditions of the people cause the problem of poverty in Indonesia to be very

diverse with strong local characteristics and different experiences of poverty. The problem of poverty is multidimensional as it is not only related to the size of income, but also the vulnerability of a person or community to become poor.

Second, Covid-19 is a disruption and shock to the process of economic development. These disturbances and shocks create vulnerability in economic activity which in turn creates econo-

mic problems. There was a reallocation of the development budget as a result of the Covid-19 outbreak to focus on health issues and economic recovery. Economic resilience is tested by this condition.

Third, improving the quality of knowledge through education and training is a national development need. Indonesia's human resources are still far behind other countries. For this reason, the quality of human resources who have knowledge and skills needs to be improved. Basically, improving the quality of education and training aims to increase the nation's competitiveness while at the same time being able to increase GRDP per capita.

The first PROMETHEE result is to determine the ranking of knowledge and culture-based development program policy scenarios for increasing GRDP per capita, reducing inc-

ome inequality, poverty alleviation, economic resilience and competitiveness based on priority and policy effectiveness. PROMETHEE analysis can be divided into PROMETHEE I analysis, partial ranking, or ranking separately and PROMETHEE II analysis, complete ranking, overall ranking. Partial ranking is calculated based on two preferences, namely outgoing flow (Φ^+) and incoming flow (Φ^-). The outgoing flow value is a positive value that indicates the strength of the selected policy scenario evaluation compared to other policy evaluations. Meanwhile incoming flow is a negative value indicating a weakness in the evaluation of the selected policy scenario. PROMETHEE II complete ranking is net flow or the difference between outgoing flows and incoming flows. In Figure 3 below, it can be seen the results of partial ranking and complete ranking of several policies based on ranking order.

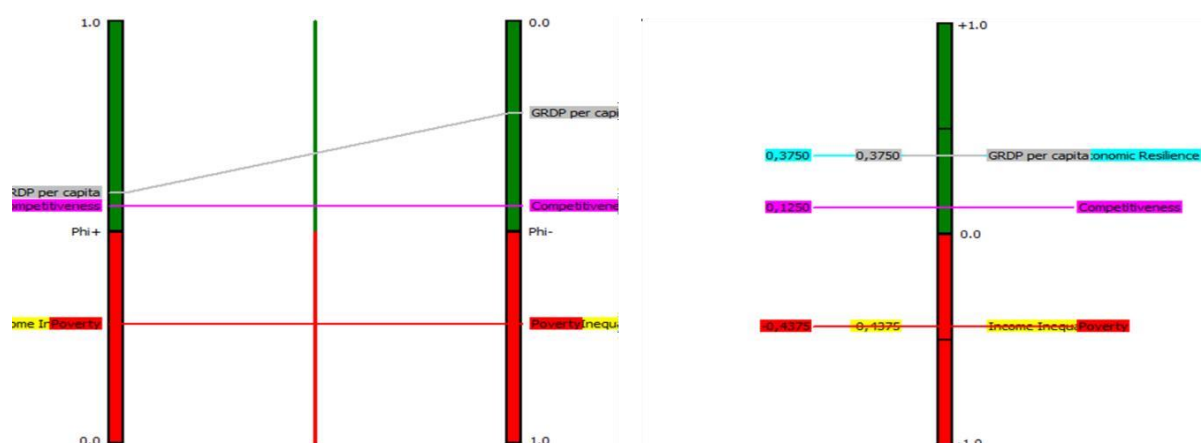


Figure 3. PROMETHEE Ranking

Economic resilience and GRDP per capita have the same value for both incoming and outgoing flows, each of which has a lower phi (-) value than the phi (+). When viewed from the complete ranking picture, the policy scenario for economic resilience and GRDP per capita is higher than the scenario for competitiveness, income inequality and poverty policies. The second priority is the competitiveness policy scenario and the third priority for knowledge and culture-based development policies is reducing income inequality and po-

verty alleviation. The net flow value can be seen in Figure 4.

From Figure 4, it can be seen that the phi score or net flow of economic resilience and GRDP per capita have the same value, which is 0.3750, while the position for 2nd place is in competitiveness with a net flow score of 0.1250. The third order is the program to reduce income inequality and poverty alleviation with a negative phi value of -0.4375.

Rank	action		Phi	Phi+	Phi-
1	Economic Resilience	◆	0,3750	0,5938	0,2188
1	GRDP per capita	■	0,3750	0,5938	0,2188
3	Competitiveness	●	0,1250	0,5625	0,4375
4	Income Inequality	■	-0,4375	0,2813	0,7188
4	Poverty	◆	-0,4375	0,2813	0,7188

Figure 4. PROMETHEE Flow Table
Development Programs

The results from PROMETHEE show that the knowledge economy sector has a strong influence on GRDP per capita and economic resilience. Meanwhile, the cultural economic sector through tourism transmission is able to increase GRDP per capita and economic resilience. The tourism sector is a variable that contributes to economic resilience through GRDP per capita under normal conditions. But on the other hand, this sector has a high vulnerability to disturbances and shocks. In the case of COVID-19 it is proven that the tourism sector has a red report and is the most affected by the shock that has been caused. For this reason, it is necessary to have a contingency plan to anticipate unwanted disturbances in the economic cycle.

Furthermore, from the perspective of PROMETHEE Rainbow, an interesting fact

emerges that the strength of Indonesia's competitiveness lies in tourism, cultural heritage and cultural participation. Indonesia is a very rich in cultural capital. If it is managed properly, it can be a superior development policy so that it becomes competitive at the world level. Meanwhile, education, technology and innovation continue to be developed thus they can become a strong supporting force so that Indonesia's vision for 2045 can be achieved (Bappenas, 2019). On the other hand, a culture-based development approach supported by political-democratic institutional policies will be able to reduce income inequality and alleviate poverty in Indonesia.

The main support for economic resilience is education. The essence of knowledge is education and through education various sciences emerge. Adequate education is able to make a person have the skills and knowledge according to his field. The higher the individual's education the higher the income. Many studies state that investment in education and training in the long-term increases labor productivity, provides higher income and quality of life, which in turn can increase household consumption and increase aggregate Gross Domestic Product.

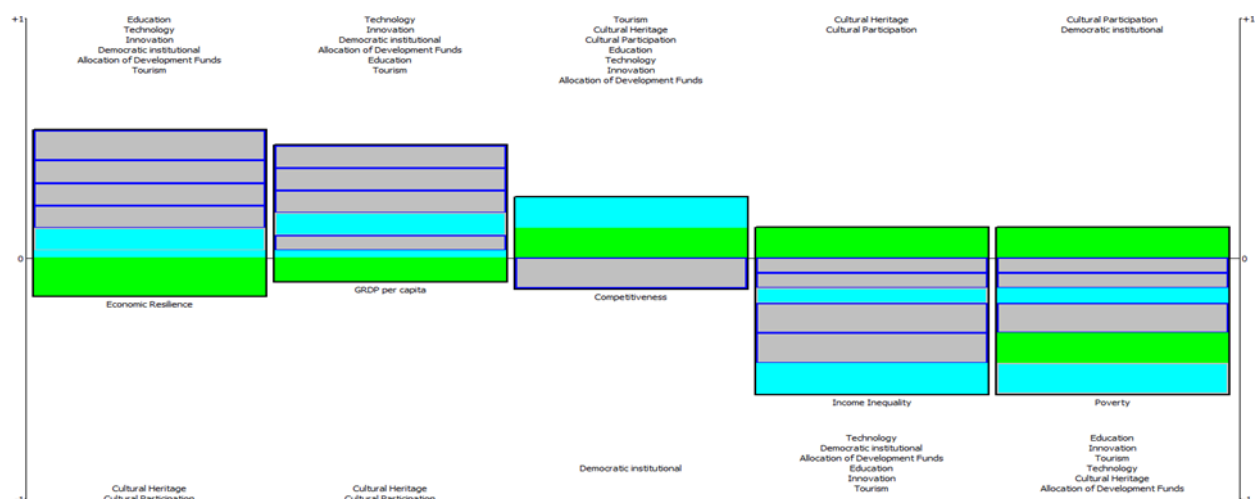


Figure 5. PROMETHEE Rainbow

Algan et al (2021) stated that a higher level of education can increase economic resilience in both the short and medium term. The results of Howard et al's research (2021) state that investment in education at the university level can increase the resilience of the local economy. While Simoes et al. (2022) from the results of his research concluded that workers with a higher level of education have a higher level of resilience and avoid threats of termination of employment when economic shocks and disturbances arise.

Meanwhile, the role of technology and various innovations 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. Based on the KOMINFO Annual report (2020) Base Transceiver Stations (BTS) have been built in 1,682 villages and sub-districts throughout Indonesia to serve Information Communication Technology (ICT) services to remote communities, especially in frontier, outer-most, and disadvantaged (3T) areas which are part of a total of more than 550.00 BTS spread throughout Indonesia.

During the social distancing, many companies closed and were forced to terminate employment. The MSME sector, which is the backbone of the Indonesian economy, has not been spared from the Covid-19. The impact of the pandemic has put pressure on the economy which has led to an economic contraction. During this period, internet technology proved capable of sustaining economic resilience. The digital economy sector is able to slow down the decline in economic growth. The digital economy is able to grow very significantly through e-commerce and financial technology channels and make a real contribution to economic growth. These results are in line with the research by Pierri & Timmer (2020) who studied the economic impact of information technology (IT) adoption during the COVID 19 pandemic using data on IT adoption covering nearly three million companies in the United States, and found evidence that technology adoption can partially protect the economy from the impact of the covid 19 pandemic.

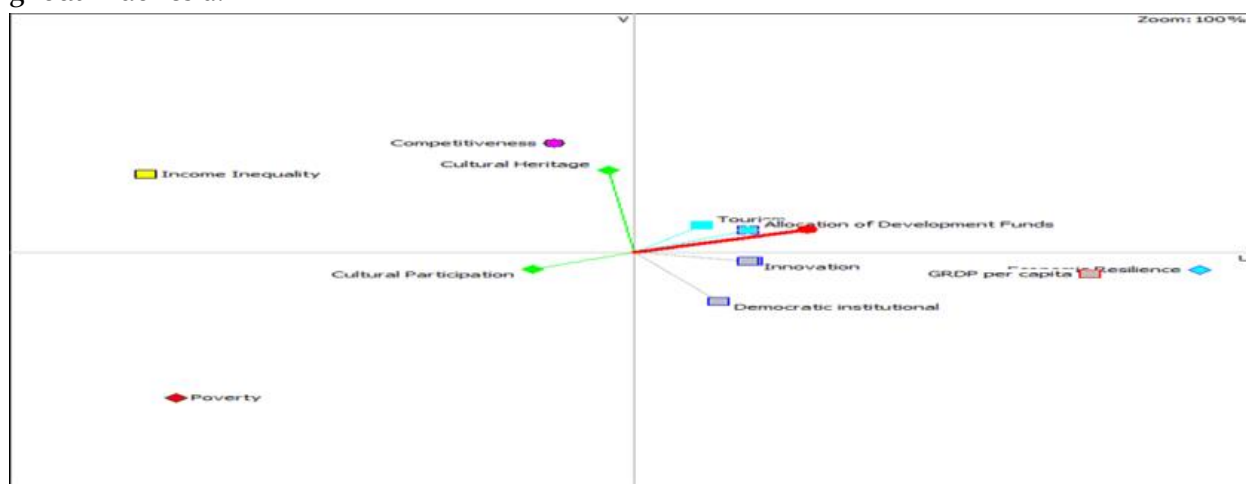


Figure 6. GAIA Visual Analysis

Figure 6 is a GAIA Visual analysis using the principal component analysis calculation principle. The choice of dimensions chosen is U-V because it gives the highest quality value, namely = 85%. The U dimension indicates

that the first principal component has the maximum information that can be provided. Meanwhile, the dimension V has a maximum of orthogonal additional information with respect to U.

From Figure 6, it can be seen that GRDP per capita and economic resilience lie in the main dimensions U and V and are closest to the centre of the axis on the graph, while from the perspective of the closest criteria are the dimensions of the knowledge economy, namely education, innovation, institutions, technology. Another dimension is tourism and development funds. On the other hand, cultural heritage, cultural participation and tourism are closer to competitiveness priorities. The cultural participation criterion is the closest to evaluating poverty alleviation. Cultural heritage is the second closest criterion for evaluating inequality, after the evaluation of competitiveness.

Poverty is a complex problem. Apart from the different problems and conditions in each region, poverty is dynamic because it changes from time to time. The World Bank attempts to create an international poverty line based on purchasing power parity (PPP) exchange rates taking into account differences in relative prices across countries. Based on research by Jolliffe et al. (2022), the calculation of the PPP exchange rate for the 2011 international poverty line was USD 1.90, resulting in a new PPP international poverty line for 2017 of USD 2.15.

The international poverty line issued by the World Bank has always changed since 1985 which is adjusted to the PPP exchange rate which takes into account changes in relative prices. Dartanto and Nurcholis (2013) in their research stated that because the incidence of poverty can change from time to time, it is important to conduct a dynamic analysis to distinguish between chronic poor, temporary poor and never poor; to discover which determinants differentiate between groups; and to evaluate the effectiveness of

government policies in changing the status of poverty in Indonesia.

In relation to the tourism sector, it is necessary to strengthen mutual cooperation behavior and provide opportunities for community participation to form joint business entities or in the form of cooperatives to participate in providing tourism support facilities. Thus local people can increase income while reducing income inequality. Poverty alleviation programs must be supported by regional political-democratic institutions. Decisions and development programs must prioritize people's welfare in accordance with the mandate of the 1945 Constitution article 33.

One example of the success of development innovation with cultural and social capital is Banyuwangi Regency. Banyuwangi uses cultural attractiveness for tourism. Social capital is used to mobilize all layers of society to develop in mutual cooperation led by regional heads and supported by the role of political-democratic institutions. Banyuwangi is a rapidly developing region. Based on BPS data, Banyuwangi Regency's GRDP has almost tripled, from 20.49 million in 2009 to 55.27 million in 2019. During the 2010-2018 periods, it was recorded that tourist visits increased tenfold from 12.5 thousand tourists. increased to 127 thousand tourists and the poverty rate was reduced from 11.2% to 7.8%.

Nevertheless, it is very important to know the root of the problem of poverty in Indonesia. Yogyakarta is known as a knowledge-based-economy city, but is the province with the highest Gini index in Indonesia in 2020. Meanwhile, the percentage of poor people is the highest compared to other provinces in Java. Based on a 2020 study by the Central Bureau of Statistics and the Yogyakarta Regional Planning Agency, the education level of the lowest expenditure group is only able to complete elementary school, while the highest expenditure group is able to complete tertiary education. In addition, there

is also an imbalance between sectors. Research by Wijaya et al. (2021) stated that the agricultural sector has a much lower income compared to non- agricultural.

Two other provinces that have income inequality with a Gini index above 4.00 are Gorontalo and West Java. Based on BPS data, Gorontalo's Gini figure has increased in the 2018- 2019 period, from 0.403 to 0.42, but the percentage of poor people actually decreased in the same period from 16.81% to 15.52%. The income of the rich has increased more than the income of the poor. West Java is a province with moderate education indicators. The literacy rate reached 98.6%, the school enrollment rate was 71.17% and the average length of schooling was 8.55 years. Half of the labor force by education graduated from tertiary institutions and worked in urban areas, while the labor force who graduated from elementary school worked in rural areas. One of the causes of inequality in West Java is education which results in income inequality between urban and rural areas. The percentage of poor people in rural areas is 9.58%, while in urban areas is 5.98%.

From the results of the sensitivity analysis of all the criteria used, there are three criteria for knowledge and culture-based development scenarios that have a high level of stability, namely technology, innovation, and development fund allocation. These three criteria have a stability interval of 12.50% - 100%, while for other criteria the stability interval lies in a certain weight range but not up to 100%.

These results indicate that changing the weight of the three criteria will not change the scenario of knowledge and culture-based development policies, while changing the weight of the other criteria will result in changing the policy scenario towards development program priorities. The implications of the results

of the weight stability interval analysis prove that to produce the best scenario for knowledge and culture-based development, efforts to increase the role of technology and innovation capability are needed. Figure 7 shows that technology and innovation can be weighted up to 100% without changing the scenario of knowledge and culture-based development policies.

Table 2. Weight Stability Interval Analysis

No	Criteria	Weight Stability Interval
01	Education	12.5% - 12.5%
02	Technology	12.5% - 100%
03	Innovation	12.5% - 100%
04	Democratic Institutions	0.00% - 12.5%
05	Cultural heritage	0.00% - 12.5%
06	Cultural Participation	12.5% - 12.5%
07	Tourist	12.5% - 34.38%
08	Allocation of Development Funds	12.5% - 100%

Source: data processed, 2024

The knowledge-based economy relies heavily on technology and innovation capabilities. Technology and innovation have proven to be able to function as engines of economic growth in developed countries such as the United States, China, Japan and South Korea. During the shock caused by the corona, technology emerged as a solution in various sectors, both the commercial, trade and education sectors. The learning and teaching process does not stop even though the social distancing policy is implemented. With the existence of internet technology, work can be done from home. Work location is not a serious obstacle with the advancement of technology. Technological innovation has been able to facilitate human life in all sectors, such as education, employment, health and many other sectors. Meanwhile, innovation is not only centred on technology but also inventions in the form of facilitating the production process, finding superior seeds, new ways which can increase work

productivity and efficiency in various sectors of work and the economy.

In this scenario, education is expected to no longer be traditional but to emphasize technology and innovation. The learning process is encouraged not only to receive one-way knowledge but to motivate students to think creatively, critically, comprehensively and innovatively and by utilizing and mastering technology. The “Freedom to Learn” program is a breakthrough in the field of education that is capable of driving technology and innovation-based educational policy scenarios. Knowledge, technology, and innovation will be the keys to successful sustainable development that will bring people throughout Indonesia to prosperity.

On the other hand, the cultural economic sector must also be supported by technology and innovation. The cultural economic sector through tourism has a high vulnerability to disturbances and shocks in the economic sector. Indonesia has great potential in the tourism sector. Indonesia has beautiful nature and is also supported by strong cultural capital in the form of material and non-material heritage. Regions throughout Indonesia have the potential for tourist destinations, both local and foreign. With technology and innovation, it is hoped that it will make it easier for tourists to plan and travel more easily. If there is a disruption to the economic cycle, technological sophistication can be used as a means of promotion and does not prevent tourists from enjoying the beauty of Indonesian culture virtually.

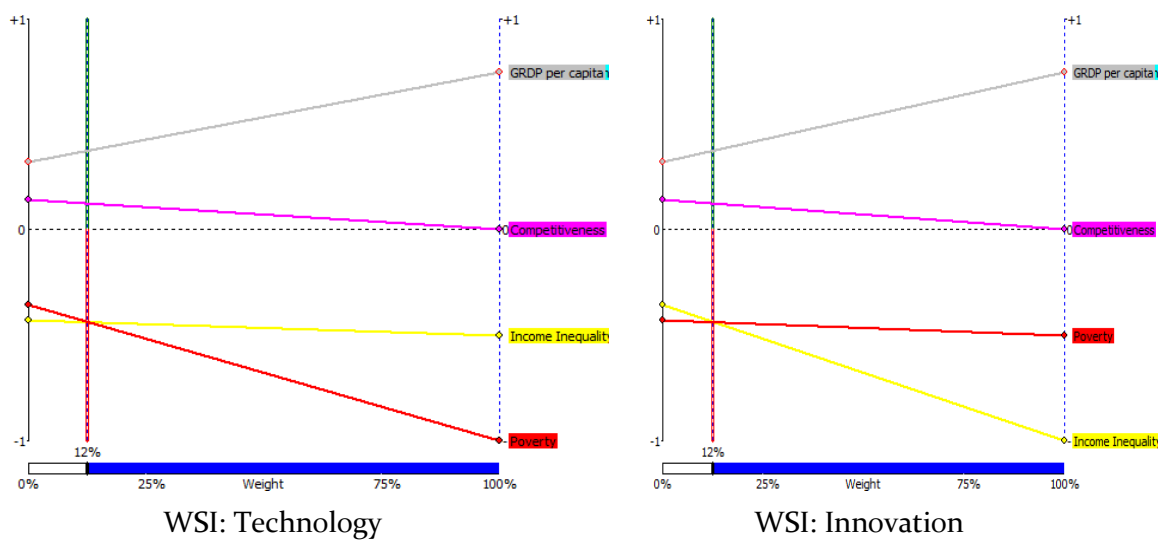


Figure 7. Weight Stability Interval Technology and Innovation Criteria

The determination of the province that achieves the highest score with the knowledge and culture-based development policy scenario can be seen in Figure 8. In this figure DKI Jakarta, Yogyakarta and Bali are the provinces with the highest scores based on the knowledge and culture-based development policy scenario. DKI Jakarta is the province with the highest knowledge economy sector, while the

cultural-tourism economic sector is also relatively high, thus placing DKI province with the highest knowledge and culture-based development policy scenarios in Indonesia. While Yogyakarta and Bali are known as centers of culture and tourism and the knowledge economy sector is relatively high compared to other provinces in Indonesia.

Knowledge and culture-based policy scenarios in the provinces of Yogyakarta and Bali are very appropriate and must be strengthened with supporting policies. Yogyakarta is known as the province of the center of education, culture and tourism. Meanwhile, Bali is a tourist destination from all corners of the world. On the other hand, it is necessary to strengthen tourism through policies and facilities based on health and technology, considering that the disruption caused by Covid-19 has resulted in very deep pressure and contraction in the tourism sector.

The ten lowest provinces in implementing knowledge and culture-based development policy scenarios are Lampung, South-east Sulawesi, West Nusa Tenggara, Central Sulawesi, Gorontalo, East Nusa Tenggara, Papua, North Maluku, West Papua, West Sulawesi. Most of these provinces are in the eastern Indonesia, except for Lampung.

These provinces have less potential for a knowledge economy and a culture-tourism economy than other provinces in Indonesia. The government through Bappenas already has a development equity program, especially in the Nusa Tenggara, Maluku and Papua regions. In addition to infrastructure development and regional interconnection, it is also necessary to pay attention to the knowledge economy and cultural economy sectors. West Nusa Tenggara and East Nusa Tenggara have become the targets of the Super Priority Tourism Destination area development plan. These two provinces have the potential for natural beauty and cultural capital in the form of cultural heritage which can become a tourist attraction. This regional development plan is expected to be able to become a domino effect of regional development. On the other hand, tourism development must be supported by qualified human resources. Loc-

al community participation must be encouraged and become a priority target for training and development which in turn is able to act professionally according to the required area of expertise.

In addition to equitable development of human resources, it is also necessary to have equitable development in the field of information and communication technology (ICT) infrastructure, especially internet access. Even though the ICT development program to reach the 3T (Frontier, Remote, Disadvantaged) areas continues to run, there are still many areas in Indonesia that do not have internet access. Equal opportunity for access to information will be able to reduce social and economic inequalities and gaps in access to information. With equitable distribution of ICT infrastructure development, it is hoped that it will be able to boost economic growth in Indonesia's eastern regions. In addition, it is necessary to strengthen the role of political-democratic institutions in the region so that development aimed at the welfare of society can be achieved.

In accordance with the results of the previous analysis, knowledge and culture-based development policy scenarios throughout Indonesia must pay attention to educational equity as the nucleus and DNA of the policy scenario, while the basis of this policy scenario is technology and innovation. Regional development programs are directed at the use of technology and encouraging new innovations in all employment sectors. Education does not only rely on traditional models, but encourages an educational curriculum introducing technology and teaching that can stimulate the emergence of inventions, ideas, creativity in problem solving. In addition to the development of ICT infrastructure, literacy in technology must get a bigger portion in the teaching process.

Rank	action		Phi	Phi+	Phi-				
1	DKI Jakarta	◆	0,8984	0,9492	0,0508	17	Kalimantan Selatan	●	-0,0391 0,4805 0,5195
2	D I Yogyakarta	◆	0,6953	0,8477	0,1523	18	Bengkulu	■	-0,0820 0,4570 0,5391
3	Bali	■	0,5313	0,7656	0,2344	19	Kalimantan Barat	●	-0,1836 0,4063 0,5898
4	Jawa Barat	◆	0,4375	0,7188	0,2813	20	Jambi	■	-0,1953 0,4023 0,5977
5	Kalimantan Timur	●	0,4258	0,7109	0,2852	21	Kalimantan Tengah	●	-0,2539 0,3711 0,6250
6	Jawa Timur	◆	0,3672	0,6836	0,3164	22	Maluku	■	-0,2578 0,3711 0,6289
7	Sumatera Utara	■	0,3438	0,6719	0,3281	23	Bangka Belitung	■	-0,2617 0,3672 0,6289
7	Jawa Tengah	◆	0,3438	0,6719	0,3281	24	Sulawesi Tenggara	◆	-0,2695 0,3633 0,6328
9	Riau	■	0,3047	0,6523	0,3477	25	Lampung	■	-0,2734 0,3633 0,6367
10	Sumatera Barat	■	0,2656	0,6328	0,3672	26	Nusa Tenggara Barat	■	-0,2813 0,3594 0,6406
11	Kepulauan riau	■	0,2227	0,6094	0,3867	27	Sulawesi Tengah	◆	-0,2969 0,3477 0,6445
12	Sulawesi Selatan	◆	0,2031	0,6016	0,3984	28	Gorontalo	◆	-0,3008 0,3477 0,6484
13	Banten	◆	0,1484	0,5703	0,4219	29	Nusa Tenggara Timur	■	-0,3203 0,3398 0,6602
14	Sumatera Selatan	■	0,1328	0,5664	0,4336	30	Papua	■	-0,4844 0,2578 0,7422
15	Sulawesi Utara	◆	0,0938	0,5469	0,4531	31	Maluku Utara	■	-0,5859 0,2070 0,7930
16	Aceh	■	0,0859	0,5430	0,4570				
17	Kalimantan Selatan	●	-0,0391	0,4805	0,5195				

Figure 8. PROMETHEE Flow Table Provinces in Indonesia

CONCLUSION

The results of the analysis using the PROMETHEE scenario of knowledge and culture-based development policies show that based on the priority order and the effectiveness of development, the first thing that must be done is to strengthen economic resilience and increase GRDP per capita. Second, increasing competitiveness with the abundant cultural capital owned by Indonesia through the tourism transmission gate. The third is reducing income inequality and alleviating poverty. For outranking scenarios of knowledge and culture-based development policies at the provincial level, ten provinces have the highest ranking compared to others: DKI Jakarta, DI Yogyakarta, Bali, West Java, East Kalimantan, East Java, North Sumatra, Central Java, Riau, and West Sumatra.

The development policy scenario is relatively new because it departs from a knowledge and culture-based development model.

To achieve the goals of Indonesia Gold Vision 2045, Indonesia cannot only rely on natural resources, but must start empowering its human resources who have technological knowledge and innovation capabilities. Meanwhile, it is also necessary to strengthen the role and function of democratic institutions to support the achievement of development goals, namely the welfare of all Indonesian people. On the other hand, apart from having abundant natural resources, Indonesia also has rich cultural resources. Cultural capital besides having high cultural value, also has economic value, one of which is through its attractiveness which is able to invite both domestic and foreign tourists to visit. Good and professional management of cultural heritage is required.

Cultural heritage must be managed and maintained properly so that it becomes a tourist attraction that brings in foreign exchange for the country. On the other hand, revenue from the tourism sector must provide economic benefits

for local communities. Unfortunately, the cultural economy sector through tourism has a very high level of vulnerability. The Covid-19 pandemic has made this sector experience an economic contraction. Provinces that rely on the tourism sector from foreign tourists, such as the province of Bali, experienced the longest economic contraction compared to other provinces. For this reason, planning and anticipation are needed to deal with a sudden shock. The role of technology and innovation is very important.

More in-depth research can be carried out using a field study approach and using primary data, especially for the cultural economy sector. Secondary data related to the cultural economy still has limitations, while the scope of culture and its relation to development is very broad. Cultural economics can be studied from the perspective of the nature of trust, the spirit of mutual cooperation, beliefs, values and preferences of a society. Development policies that pay attention to the knowledge economy sector and the cultural economy have unlimited space because they are very dynamic.

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