Indonesia Sustainable Welfare Index (ISWI)

Measuring Sustainable Economic Welfare at Digital Era

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Abstract

The objectives of Sustainable Development Goals (SDGs) include increasing sustainable use of natural resources as to ensure the welfare of current and future generation as well as to attain the environmental sustainability. Indonesia has long established an index of economic welfare, yet it only measures social, economic and government dimension. Recently, the effect of digitalization era has renewed the demand for welfare indicators and has also made "big data" a promising data source. This study proposes an Indonesia Sustainable Welfare Index (ISWI) method which can measure economic welfare in Indonesia in the digital era and accomplish the objectives of SDGs. Considering the effect of digital era on welfare, it does not only use statistical data from NSO and other related ministries but also explores the Big Data from Google Trends. The Google Trends data is collected by Kofax Kapow™ robots. The statistical data and google trends data are then combined and transformed before they are tested by using Structural Equation Modeling (SEM). The result of SEM analysis shows that the growth of current welfare is not followed by the increase of environmental quality. In addition, the changes caused by digitalization and level of people's expectation to consume have positive effects on welfare. Hence, this new welfare index is more suitable for accommodating environmental quality, consumer expectation, and digital effects.

ISWI contains social, economic, government, environmental, digital, and expectation dimension. ISWI is conducted by calculating the proportion of Factor Analysis results in each dimension and is determined by the average value of all the dimensions. The indicators used in ISWI represent Indonesian people and the attempt to achieve welfare in Indonesia. They also accommodate various indicators that are used to evaluate country's development.

Contents

I. Introduction

Welfare has been calculated by many countries through various methods such as the Human Development Index (UNDP), Gross National Happiness (GNH), Quality of Life Index, Prosperity Index (Legatum, London), The Better Life Index (OECD Country) and The Economic Well-being Index (EWI). The Prosperity Index, in particular, is commonly used to compare welfare between countries.

Indonesia has established an index of economic welfare, known as *Indeks Kesejahteraan Rakyat* (IkraR), which has been adapted to the cultural, social, and economic condition in Indonesia. It has been developed since 2012 by Ministry of Social Welfare Indonesia collaborate with Statistics Indonesia and is measured by three dimensions—social dimension, economic dimension, and dimension of democracy and governance which consists of 22 indicators. During the development of IKraR, eight indicators were adopted in accordance with the real condition of the community in Indonesia and were also adjusted to the availability of data at BPS. While the indicators might have represented the present condition for analyzing the development in Indonesia, the calculation technique does not utilize data based on digital era and also does not focus on technological growth, which is likely to influence human behavior and in turn affect the level of welfare.

Furthermore, the Human Development Index (HDI) is an instrument developed to see country's efforts in human development through a number of indicators, which are important in understanding the development conditions. As time goes, development becomes more complex and requires an expansion of the indicators in order to enrich understanding in the area of policymaking. In this context, the Welfare Index involves calculating the quality of life based on the fulfillment of a person's basic rights and also complementing the HDI as an instrument in explaining human development—particularly its achievements and welfare.

On the other hand, there is a possibility that the biggest problem faced by the community is not the availability of services but the lack of access to the services itself. It will be necessary therefore to assess the output, allowing a two-directional assessment. HDI and Ikrar are carried out separately in order for a measuring tool to be able to assess simultaneously. After all, in a simple process, generally there will be no output without any input or access available. Thus, it is important to find out whether input or access to attain people's welfare is available.

Global warming and climate changes become the main issues in every country, affecting its development paradigm. Development is not only measured through the socio-economic aspects, but also in terms of sustainability of natural resources. Thus, development that only pursues socio-economic growth without any regard to environmental sustainability is no longer enough because future generations also have the same rights to the resources as the current one.

IKraR, as Indonesia's welfare indicator, accommodates indicators and targets included within the achievement of the Millennium Development Goals (MDGs). MDGs target achievement, which had yet to include environmental aspects as its main priority, ended in 2015 and was then shifted into SDGs. Based on the objectives of Sustainable Development Goals (SDGs), the government should be able to provide welfare for its citizens without depleting the natural resources and/or damaging the environment. After all, the impact caused by environmental damage can be very costly. A welfare index which also takes environmental aspects into consideration is much needed.

Daly and Cobb (1989) introduced Index of Sustainable Economic Welfare (ISEW), which did not only measure welfare based on economic indicators but also on the environmental ones. Eric Neumayer (1999), however, believed that the ISEWs lacked a sound theoretical foundation. He stated that their conclusions were highly dependent on certain key and rather arbitrary assumptions about the weighting of income distribution, the valuing of the depletion of non-renewable resources and long-term environmental damage and the neglect of technical progress and increases in human capital. Moreover, he argued that the ISEWs and their authors in criticizing GNP for its deficiencies as an indicator of welfare missed the point since GNP was never thought of as providing this function by its founders.

During the digital age, technology grows rapidly and creates a knowledge-based society surrounded by a high-tech economy. The Internet and smartphone have become a necessity for people's daily life, because they provide a means for people to access various kinds of facilities among their many functions. This rapid change has affected many sectors including social, economic, and welfare. Digitalization encompasses a wide range of new applications of information technology in business models and products that are transforming the economy and social interactions; it is both an enabler and a disruptor of businesses (IMF, 2017).

Furthermore, with the growth of the Internet, search engines have become an indispensable tool for those who are trying to get any particular information and require suggestion in order to make a decision. One of the most popular search engines is Google, which, despite its many shortcomings, can provide information without lags. The data recorded from the Google search shows the demand for information by topic from internet users around the world, so they contain insights into a large part of the human condition (Bortoli, Combes, 2015).

The amount of data that's being created and stored worldwide is almost inconceivable, and it just keeps growing. Interpreting the data would require a high level of skills, although it should not be a problem for any researchers. Google has launched Google Trends, which provides a summary of the search history in the form of graphics. It surely can help researchers in analyzing people's activity and can also be used to predict human behavior.

Google Trends is a very promising new source of data to see individual consumption. Almost in all experiments conducted with the Google indicators' in-sample and out-of-sample, the predictive power turned out to be better than that of the conventional survey-based indicators. Other methods of category selection might enhance the indicators predictive power even further. Since 2008, Google has also been providing data specifically for product searches and the respective categories should be even more suitable for consumption forecasts, as they are more related to purchases than the other web search queries (Schmidt, T, and Vosen, S, 2009). Although not all keyword searches from the internet search data can be analyzed, some of them have proven to have the same analysis result with conventional method. For example, Hedonic value is a determinant of the consumer intention to search and purchase; whereas search intention has a direct impact on purchase intention (Toipaloglu, 2012).

This paper focuses on establishing an economic welfare index in Indonesia, called Indonesia Sustainable Welfare Index (ISWI), based on indicators that are adapted to the realities in the digital era as well as aimed to achieve the objective of SDGs. MDGs target achievement has ended in 2015, leaving SDGs as the next-in-line. Hence, this paper would analyze the data from 2012, in which IKraR was implemented, to 2015. It would also examine the indicators by using the implemented indicator and also by conducting theoretical studies based on SDGs. The data used in this study comes from both NSO's statistical data and also Google Trends Data.

II. Literature Review

A. IKraR

IKraR (Indonesia Welfare Index) are :

- Index used to assess the level of people's welfare in Indonesia
- Measuring tools used to assess the success of inclusive development
- Measuring the availability of access to the fulfillment of basic rights of the people.

The Ikrar measures welfare which is holistic; it does not simply encompass welfare from an economic or social point of view but actually includes economic, social, and political welfare. Furthermore, the welfare measurement indicator used today does not really measure the availability of access but merely the output. IKraR seeks to find out whether access to achieve the development goals, the prosperous community, is adequately available and whether the access has been utilized by the citizens.

IKraR consists of three dimensions—dimension of social justice, dimension of economic justice, and dimension of democracy and governance, which is socialized with socio-economic conditions in Indonesia.

Social Dimension

This dimension does not only involve the distribution process but also encompasses the efforts to fulfill basic needs, as well as the affirmative action taken by state administrators in order to protect and ensure that every citizen are able to attain his/her basic rights.

The indicators used are:

- Access to Electricity
- Access to Health Facilities
- Recreation
- Length of Education
- Social Security Utilization
- Life Expectancy
- Access to Clean Water
- Access to Sanitation
- Expenditure per capita

• Income Equity Level

Economic dimension

This economic dimension is more about the progress of indicators that reflect people's ownership and access to economic resources to achieve their welfare.

The indicators used are:

• Home Ownership
• Work
• Ratio of Expenditure to Poverty
• Ratio of Own-Source Revenue to Gross Regional Domestic Product
• Access to Resources
• Economy
• Ratio of Education Cost
• Ratio of Health Cost to Total Expenditure

Dimension of Democracy and Governance

Dimension of Democracy and Governance is a measurement of people's welfare, reflecting on the progress of democratic development that guarantees the right of the people to independently participate in the whole process of building democracy without any fear of discrimination. Generally, the purpose of this dimension is to encourage the attainment of people's rights in relation to their sense of legal justice and also to respect people's political rights as the nation's collective sovereign.

The indicators used are:

• Access to Information
• Sense of security
• Civil Liberties
• Political Rights
• Democratic Institution

B. Environment

According to Statistics Indonesia, environmental quality indicators encompass the quality of river water, air, and forest cover. Indonesia Environmental Quality Index (IKLH) is calculated at provincial level in order to obtain a national level index. Each

parameter in each indicator is combined into one index value. Government regulation about IKLH are as follows:

- The Ministry of Environment Decree No. 115 of 2003 concerning Guidelines for Determining the Status of Water Quality. This guideline also regulates procedures for calculating water pollution index (IPA) or water quality index (IKA).
- The Ministry of Environment Decree No. Kep-45/MENLH/10/1997 concerning Index of Air Pollutants.
- Land/forest cover index uses the standardforest area regulated by the Ministry of Forestry in each province.
- Index calculation for river water quality indicators is carried out based on the Ministry of Environment Decree No. 115 of 2003 concerning Guidelines for Determining the Status of Water Quality.

The standard or the applicable provisions based on the laws and regulations issued by the government, such as provisions on water quality standards and ambient air quality standards, may be used as a comparison or even the intended target for each indicator. In addition, they can also be used as a reference on an international scale as to get a grasp of an ideal reference.

C. Expectation

Early information on economy can also be analyzed through the Consumer Tendency Index (ITK), obtained through the Consumer Tendency Survey (STK). This survey aims to obtain a general overview of business and economic condition, derived from the economic condition of consumers themselves who consume both goods as well as services produced in the economy. In addition, the index also illustrates the condition of consumers in the next three months as indicated by the consumer plans, which shows their willingness to pay or purchase durable goods.

The information collected for the survey usually includes household income, influence of inflation on the consumption of food (fish, meat, eggs, milk, fruits, etc.) and non-food products (clothing, housing costs, education costs, transportation, health costs, recreation, etc.) Additionally, more information would also be collected on the plans to purchase durable goods (houses/land, cars, motorbikes, investments,

electronics, home appliances, TV, computers, etc.), recreation, parties, and celebrations.

ITK also consists of two types of indices, namely Current Indicator Index and the Future Indicator Index. Current Indicator Index is a composite index of several variables that can identify (consumers') household economic conditions in the current quarter (during the survey) compared to the previous quarter. On the other hand, Future Indicator Index is a composite index of several variables that can predict the (consumers') household economic conditions in the next three months.

D. Google Trends

Google Trends provides an index of volume of Google queries by geographic location and category. The Google Trends data does not report the raw level of queries for a given search term; rather, it reports a query index. The query index starts with the query share—the total query volume for the search term in a given geographic region divided by the total number of queries in that region at one point in time. The query share numbers are normalized so that they would start at 0 on January 1. Numbers at later dates indicates the percentage deviation from the query share on January 1. This query index data is available at country and state level for the United States and several other countries. There are two front ends for Google Trends data, but the most useful one for our purposes is http://www.google.com/insights/search which allows user to download the query index data as a CSV (Choi & Varian, 2009).

- Interest over time

  Numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term.

- Region

  Search term popularity is relative to the total number of Google searches performed at a specific time, in a specific location. Hover over a region to get more details on search volume in a region. Google Trends also provide a list of regions or cities ranked according to the term's popularity.

E. Web Scraping

Web scraping is a set of techniques used to automatically get some information from a website instead of manually copying it. The goal of a web scraping is to look for certain kinds of information, extract, and aggregate it into new Web pages. In particular, scrapers are focused on transforming unstructured data and save them in structured databases. (Urru & Vargiu, 2013)

F. Structural equation modeling (SEM)

Structural equation modeling (SEM) is a comprehensive statistical modeling tool for analyzing multivariate data involving complex relationships between and among variables (Hoyle, 1995). SEM surpasses traditional regression models by including multiple independent and dependent variables to test associated hypothesizes about relationships among observed and latent variables. SEM explains why results occur while reducing misleading results by submitting all variables in the model to measurement error or uncontrolled variation of the measured variables (Carvalho & Chimma, 2014).

G. Factor Analysis

Factor analysis uses correlation among individual items to reduce them to a small number of independent dimensions or factors, without presuming the one-dimensionality of the scale. The correlation matrix of items indicates which statements exhibit similar patterns of responses. These items are then bundled into factors (Cleff. T, 2014).

III. Data and Methodology

A. Data

This study uses data collected by BPS (Statistics Indonesia) and other ministries, as well as Google Trends data from 2012 to 2015. It encompasses:

1. Statistical activities conducted by BPS, such as Socio-Economic Survey, Village Potential, Forestry Survey, Consumer Tendency Survey, Information Technology Survey, Indonesian Democracy Index (IDI) and other relevant statistical activities.

2. Administrative data from other ministries, some of which involve the Ministry of Environment and Forestry and also the Ministry of Social Welfare in Indonesia.
3. Graphic(s) from Google trend, obtained by exploring keywords in Bahasa Indonesia that have been googled since 2012. The aforementioned keyword is:
    - Consumer expectation: includes several popular brands of household durables such as transportation, housing, recreation, and communication.

B. Variables

Table 1. Operational Definition

Dimension	Indicator	Description
(1)	(2)	(3)
Social Dimension	ikr_ds_water_	Access to Clean Water: Percentage of households that use clean water as a source of drinking water
	ikr_ds_toilet_	Access to Sanitation: Percentage of households that use their own latrine / shared toilet
	ikr_ds_p0	Percentage of non-poor population
	ikr_ds_gini_n	Revenue Equity
	ikr_ds_electricity_	Access to Electricity: Percentage of households that use electricity as the main lighting source
	ikr_ds_care_	Access to Treatment: Percentage of population who can enjoy access to treatment for the past 6 months
	ikr_ds_recreation_	Recreation: Percentage of households doing recreation (vacation, sports/art)
	ikr_ds_mys_	Length of Education: Average population length of education + 15 years (years)
	ikr_ds_jamsos_	Social Security Utilization: Percentage of households receiving social security programs (Jamkesmas, health cards, Surat Miskin (SKTM), others)
	ikr_ds_e40_	Life expectancy: Percentage of the population who are 40 years old
Economic Dimension	ikr_de_home_	Ownership of Own Houses: Percentage of households that have their own homes

Dimension	Indicator	Description
(1)	(2)	(3)
	ikr_de_work_	Work: Percentage of population aged 15 years and over who work
	ikr_de_expgk	The average ratio of per capita expenditure per month to the poverty line (GK)
	ikr_de_pad	The ratio of Own Source Revenue to Gross Regional Domestic Product
	ikr_de_bank_	Access to Economic Resources: Percentage of households receiving credit from banks
	ikr_de_shstudall	Education Cost Ratio: Proportion of household expenditure on education costs to total expenditure on total expenditure
	ikr_de_shheall	Health Cost Ratio: Proportion of household expenditure for health costs to total expenditure
Government Dimension	ikr_dp_inet	Access to Information: Percentage of households that have accessed the internet in the last 3 months
	ikr_dp_crime	Security: Percentage of residents who have been victims of crime in the past year (adjusted)
	ikr_dp_civil_	Civil Liberties: Aspects of Civil Liberties in the Indonesian Democracy Index
	ikr_dp_politic_	Political Rights: Aspects of Political Rights in the Indonesian Democracy Index
	ikr_dp_lemdem_	Institute of Democracy: Aspects of Democratic Institutions in the Indonesian Democracy Index
Environmental dimension	env_air_quality_	Air Quality Index
	env_indeks_land_cover_	Land Cover Index
	env_indeks_water_quality_	Water Quality Index
Digital Dimension	dig_cellphones	Percentage of Population Owning Cell Phones
	dig_computer	Percentage of Population Owning Computers
	dig_cable_phone	Percentage of Population Owning Cable Phones

Dimension	Indicator	Description
(1)	(2)	(3)
Expectation Dimension	ten_itk3	Consumer tendency index
	ten_ppp	Adjusted per capita expenditure
	trend_transport	Google Trend Data : Transportation
	trend_recreation	Google Trend Data: Recreation
	trend_digital	Google Trend Data : Digital
	trend_house	Google Trend Data: Household appliances
	trend_investment	Google Trend Data : Investment

C. Methodology

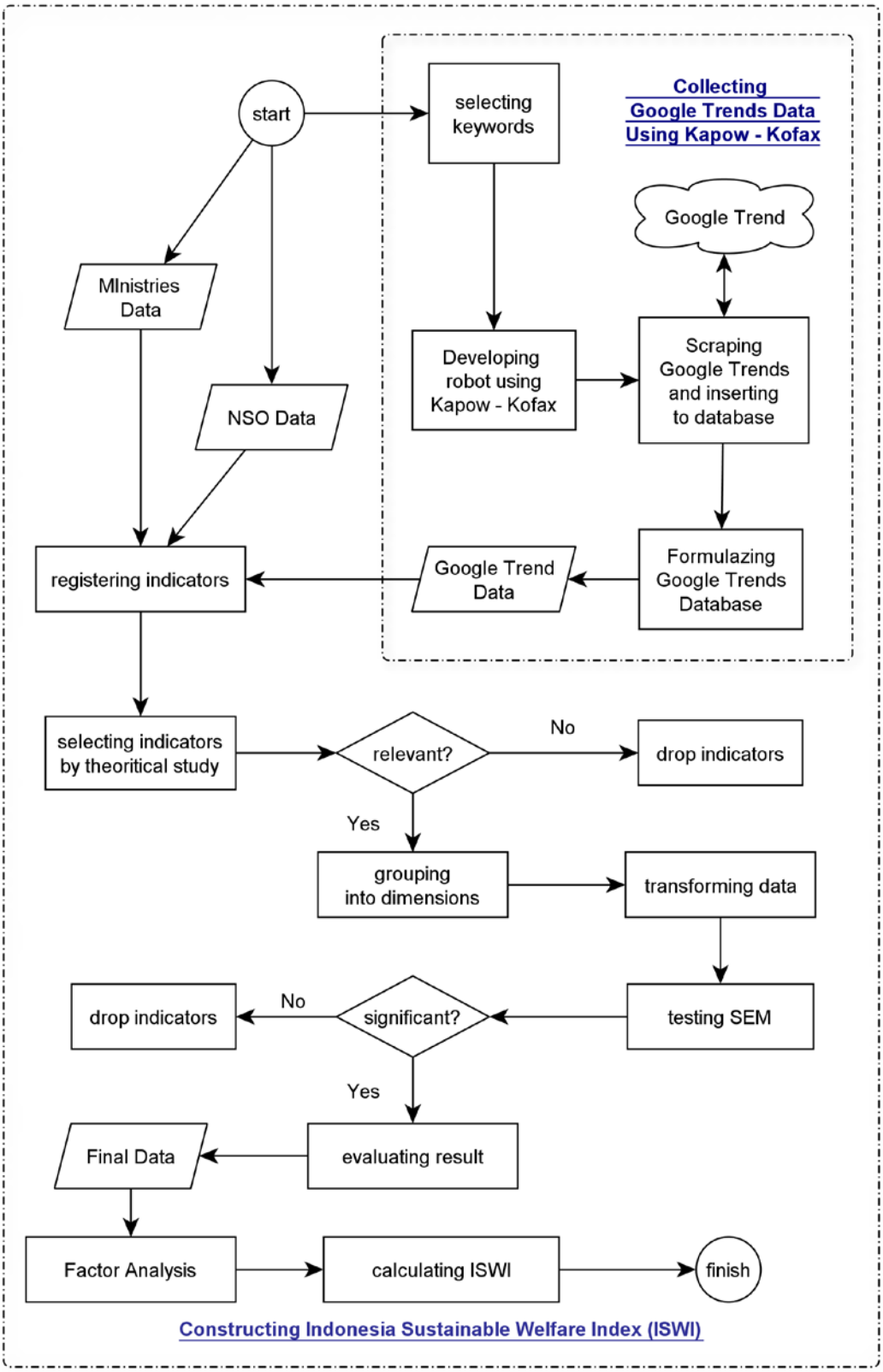


Figure 1. Flowchart in constructing ISWI index

a. Collecting Google Trend Data Using Web Scraping

The relevant keywords are selected based on the theory used in the metadata in Indonesian Statistics and previous studies. From these keywords, the Data will be downloaded from Google Trend focused only in Indonesia since 2012 and will later be inserted into the database. BPS Statistics Indonesia has a licensed Kofax© Kapow© as a tool to do web crawling. This tool is used because it capable to scrap Google Trends Data specifically is downloaded by Kofax Kapow™ robots and is transformed into indicators based on the keyword groups.

b. Constructing Indonesia Sustainable Welfare Index (ISWI)

The first step to establishing welfare index is registering indicators of welfare that have been implemented in Indonesia and some additional indicators from the dimensions of social, economy, democracy and governance, environment, and also individual expectation. The indicators are selected by conducting theoretical studies based on SDGs. In addition, the theoretical studies are also conducted to examine indicators that directly affect the welfare indicators which are in turn influenced by digitalization. Furthermore, the indicators are grouped into several dimensions: social dimension, economy dimension, dimension of democracy and governance, environmental dimension, digital dimension and dimension of individual expectation. The data that is collected from BPS' (Statistics Indonesia) statistical data and also other Ministries', are combined with Google Trends data.

Then, Indicators in each dimension are transformed into indexes ranged from 0 to 100 in order to get standard value for each indicator using the formula. The formula to transform the indicators index is as follows:

$$I_j = \frac{v_j - v_{min}}{v_{max} - v_{min}} * 100$$

$I_j = indicator's\ index - j$
$v_j = value\ of\ indicators - j$
$v_{min} = minimum\ value\ of\ indicators - j$
$v_{max} = maximum\ value\ of\ indicators - j$

Some indicators' indexes that has zero (0) as the ideal value are transformed in order to get 100 as the ideal value by using formula :

$$I_{j*} = 100 - I_j$$

The indicators' indexes are statistically tested by Structural Equation Modeling (SEM) using SmartPLS. This test is conducted to evaluate the current index welfare calculation as well as the additional indicators. From this step, we can get the final indicators on each dimension by evaluating loading factors of SEM analysis.

Establishing Indonesia Sustainable Welfare Index (ISWI) requires several stages. The first stage is calculating the weight of each indicator's index for each dimension by Factor Analysis using IBM SPSS® software. After that, the factors of values are used to form indicator weight by calculating the proportion of index values on each indicator. The indicator index value and indicator weight value are used to calculate the dimension index by multiplying the original value by its indicator weight. Finally, the ISWI is calculated by counting up the average value of those dimension indexes.

$$ISWI = \frac{S + Ec + Gov + Env + D + T}{6}$$

$S = Social\ Dimension$
$Ec = Economy\ Dimension$
$Gov = Government\ Dimension$
$Env = Environment\ Dimension$
$D = Digital\ Dimension$
$T = Tendency\ Dimension$

IV. Result and Analysis

SEM Analysis

In order to develop the current index, this study sets to evaluate the additional dimension. The aim of the evaluation is to test whether the additional dimension can be the representative for establishing sustainable welfare index. This study does not evaluate the IKraR index because it is already tested, accepted and also implemented in Indonesia for assessing the welfare index. Furthermore, the SEM Test was conducted with 95% confidence level or α = 5%. The evaluation of SEM processing results focuses on the additional dimensions—environmental dimension, digital dimension, and expectation dimension.

From the SEM test, the coefficient of determination (R^2) shows that the accuracy of this research model can explain the diversity of environmental variables, digital, and expectation towards IKraR by 78.31%. The remaining 21.69% can be explained by other variables not

included in this research model. Therefore the model designed in this research can be considered to be good or possess a good estimation value. It can be concluded that, based on two measurements of Inner Model measurement criteria, the research model has fulfilled the Inner Model criteria.

Based on SEM Test, it is clear that environmental dimension is in inverse proportion to IKraR. It means that the effect of decreasing value of the environmental dimension will be followed by the increase of IKraR. In other words, the improvement of people's welfare may not be followed by the increase of environmental quality. In fact, areas with high welfare tend to have low environmental quality. This can be a subject evaluation for the government, especially regarding the current policy on the importance of environmental indicators included in the calculation of the welfare index. The welfare of the people should ideally consider the environmental sustainability.

On the other hand, Digital dimension is directly proportional to IkraR, meaning that the effect of increasing value of the Digital dimension will also be followed by the increase of IKraR. Thus, changes caused by digitalization in a province will have a positive effect on the welfare in that region. The growth of technological advances is more likely to encourage the increase of welfare. Furthermore, the direct relationship between the Expectation and IKraR dimensions indicates that the effect of the increase in the Expectation dimension value will be followed by the increase of IKraR value. In other words, increasing the level of people's desire to consume has a direct positive effect on the value of welfare within the region.

Evaluation of SEM analysis has further showed the need to establish a method of calculating the welfare index in Indonesia which can also accommodate the levels of environmental quality and digital effects. After all, people's behaviors and lifestyles have changed a lot since the Internet becomes worldwide.

Establishing Indonesia Sustainable Welfare Index (ISWI)

Indicators and dimensions that would be included in the formulation of proposed index, known as Indonesia Sustainable Welfare Index (ISWI), have been statistically and theoretically tested. ISWI formation is conducted by calculating the proportion of loading indicator factors in each dimension. The ISWI will be established from the average value of all constituent dimensions.

The Ministry of Social Welfare in Indonesia states that welfare is the fulfillment of basic rights by the community or country that cannot be afforded by the individual. In other

words, if a country can fulfill the basic needs of its citizens who cannot afford them themselves, then the citizens in that country can be considered to be prosperous. Moreover, welfare is also a process to improve the quality of life and ability to achieve a life of dignity and independency.

Each province has unique characteristics that need a detailed and special evaluation so that ISWI formation can be built at province level each year. Areas that are able to balance the environmental quality and progress in the economy and technology will experience an increase in the ISWI index value. The ISWI does not only assesses economic, social and government dimensions, but also environmental, digital and consumer expectation dimensions.

Indicator and dimension in ISWI have been tested theoretically that it really represents people in Indonesia. Social, economy and government dimensions have also undergone a long and throughout test and discussion during the establishment of IKraR. The discussion is specifically conducted by experts, government institutions, independent institutions, and related community. Furthermore, the environment, digital and expectation dimensions are theoretically tested through literature review and SEM. The indicators used in the study involve various information that can be employed to evaluate country's development, such as:

a. Input indicators that support development program.
b. Process indicators that represent the implementation of government program.
c. Output indicators that represent the result of government program.

1. Social Dimension

This dimension does not only concern the distribution process but also involves the efforts to fulfill basic needs, as well as the affirmative action taken by state administrators in order to protect and ensure that every citizen has fulfilled his/her basic rights. For instance, the enforcement program for social justice must be able to give equal opportunities and rights for everyone. Additionally, it also must be able to rearrange the socio-economic disparities so that everyone, from the rich and poor or any kind of social groups, can gain some kinds of benefit. Based on BPS' (Statistics Indonesia) data that is published annually, high disparities are found among the provinces in Indonesia. Hence, most indicators in the social dimension will use indicators related to the provision of basic needs and public access. They can serve as a guide for policy makers at central and regional government, encouraging improvements in the provision of service, improvement of access, and reduction of social inequality in the community.

2. Economy Dimension

Indicators on this dimension are not the macroeconomic indicators such as economic growth, inflation rates, interest rates, and so on, but they actually include the same chance in gaining access and assets to economic resources. This is motivated by the idea that the current economic measurement do not reflect the real condition. For example, although economic growth is important in measuring the level of progress in achieving macroeconomic development, it does not reflect the progress of society as a whole. Economic growth will continue to happen, either slowly or rapidly, even with a selected few dominant groups that control economic resources as the only participants. Also, economic growth is not always necessarily followed by an increase in the level of people's welfare, because it could only be enjoyed by a small number of individuals.

In conclusion, this economic dimension is more about the progress of indicators that reflect people's ownership and access to economic resources to achieve their welfare.

3. Government dimension

In line with the view of Bung Hatta and a Nobel Prize-winning economist Amartya Sen, democracy and governance are important prerequisites in achieving economic and social justice since they would allow people to have sufficient opportunities to make decisions concerning their livelihood. Indonesian Constitution mentions that the State must respect, protect, and fulfill the rights of its citizens in a holistic, dignified, and sovereign manner. Several articles in Indonesian Constitution also state that people's welfare cannot be perceived only from the economic and social perspective, but must also be based on the fulfillment of civil, political and organizational rights supported by a good governance.

The Dimension of Democracy and Governance is a measurement of people's welfare by taking into account the progress of democratic development that guarantees the rights of the people to participate in the democracy process independently and with no discrimination. The purpose of this dimension, in general, is to encourage the attainment of people's rights in relation to their sense of legal justice and also to respect people's political rights as the nation's collective sovereign.

4. Environmental dimension

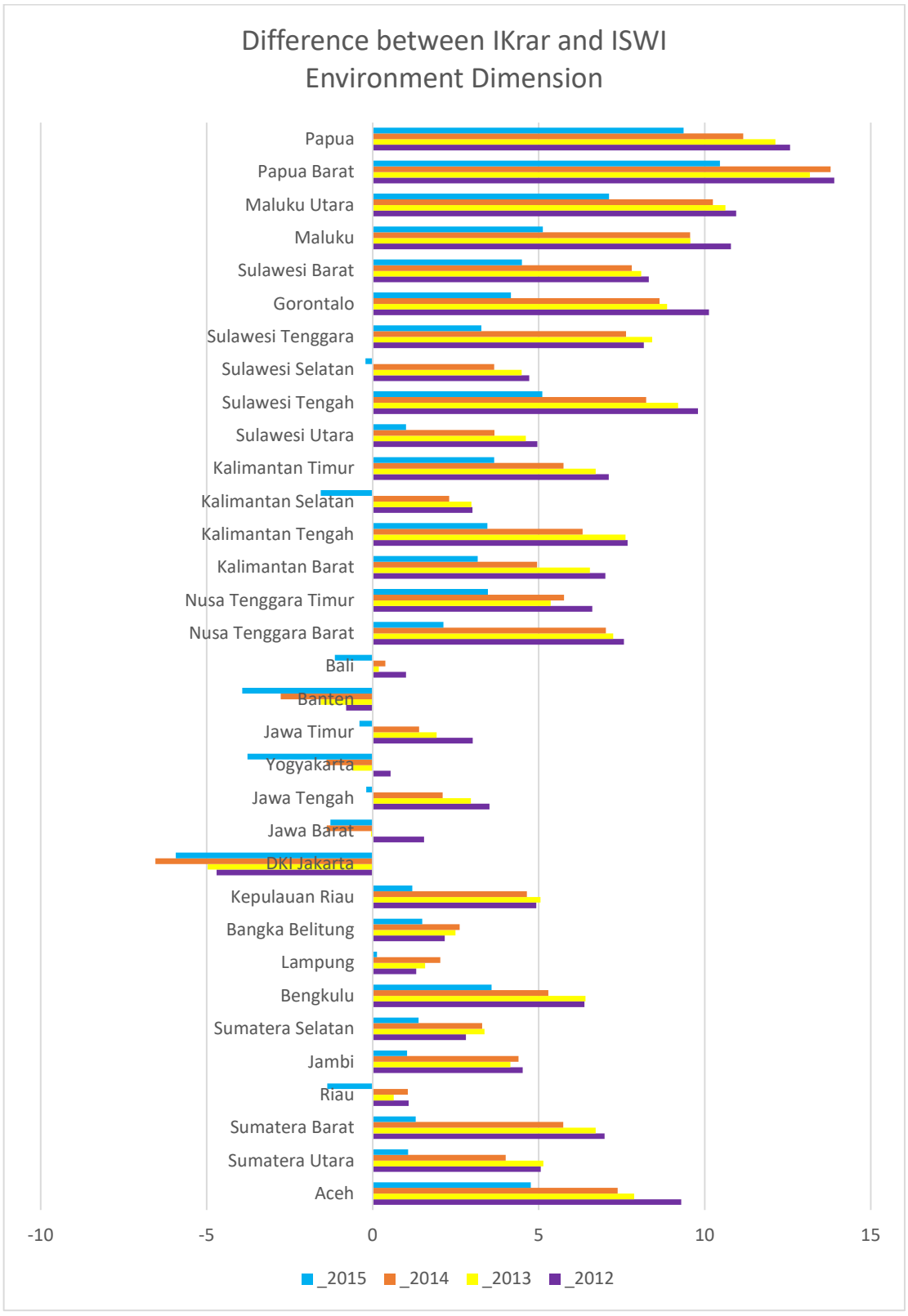


Figure 2. Gap between IKraR and ISWI Environmental dimension

Based on previous SEM testing, it can be concluded that the increase of welfare index is not followed by the increase of environmental quality. Therefore, ISWI proposed that the regions that have good environmental quality should have higher index than its IKraR index. The graphic shows that some of the regions experience an increasing index value, while the others actually encounter a decrease. It all actually depends on the quality of the environment.

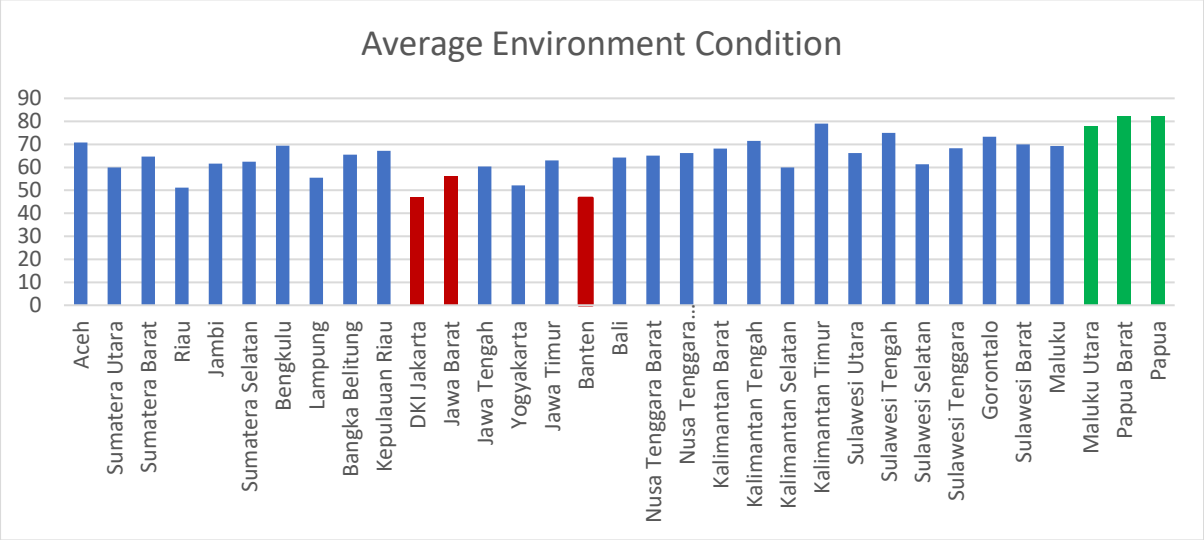


Figure 3. Average of environmental condition

The regions that have good environmental quality (in green color) get a higher value than its IKraR index. While the regions that have bad environmental quality (in red color) will get a lower value than its IKraR index.

Beckeren (1992) thinks that the loss of welfare of the population in developing countries today as a result of inadequate access to safe drinking water and sanitation, or of urban air pollution, is far greater, and should be given priority over the interests of future generations. For that reason, the quality of water, air, and environment must be kept in a good condition as to ensure the sustainability welfare for the next generation. For example, DKI Jakarta, a capital city of Indonesia, has the worst environmental quality. Today DKI Jakarta has gotten a good welfare state due to many factors, particularly for its economic and digital sectors. However, the same thing may not happen to the future generations if DKI Jakarta does nothing to improve its environmental quality. Eventually it will become a big metropolitan city yet it will not be a comfortable place to live.

The point is that any kind of development must also consider the sustainability of environment and natural resources. Development that only pursues growth without any regard

to environmental sustainability is futile because future generations also have the same rights as the generation that lives today.

5. Digital Dimension

Based on previous SEM testing, it can be concluded that the increase in digital dimension is also followed by the increase of Ikrar Index. ISWI proposed to add the digital dimension in order to further analyze the effect of digitalization on Indonesia's welfare. The provided index shows that the province with more digital technologies has the higher value.

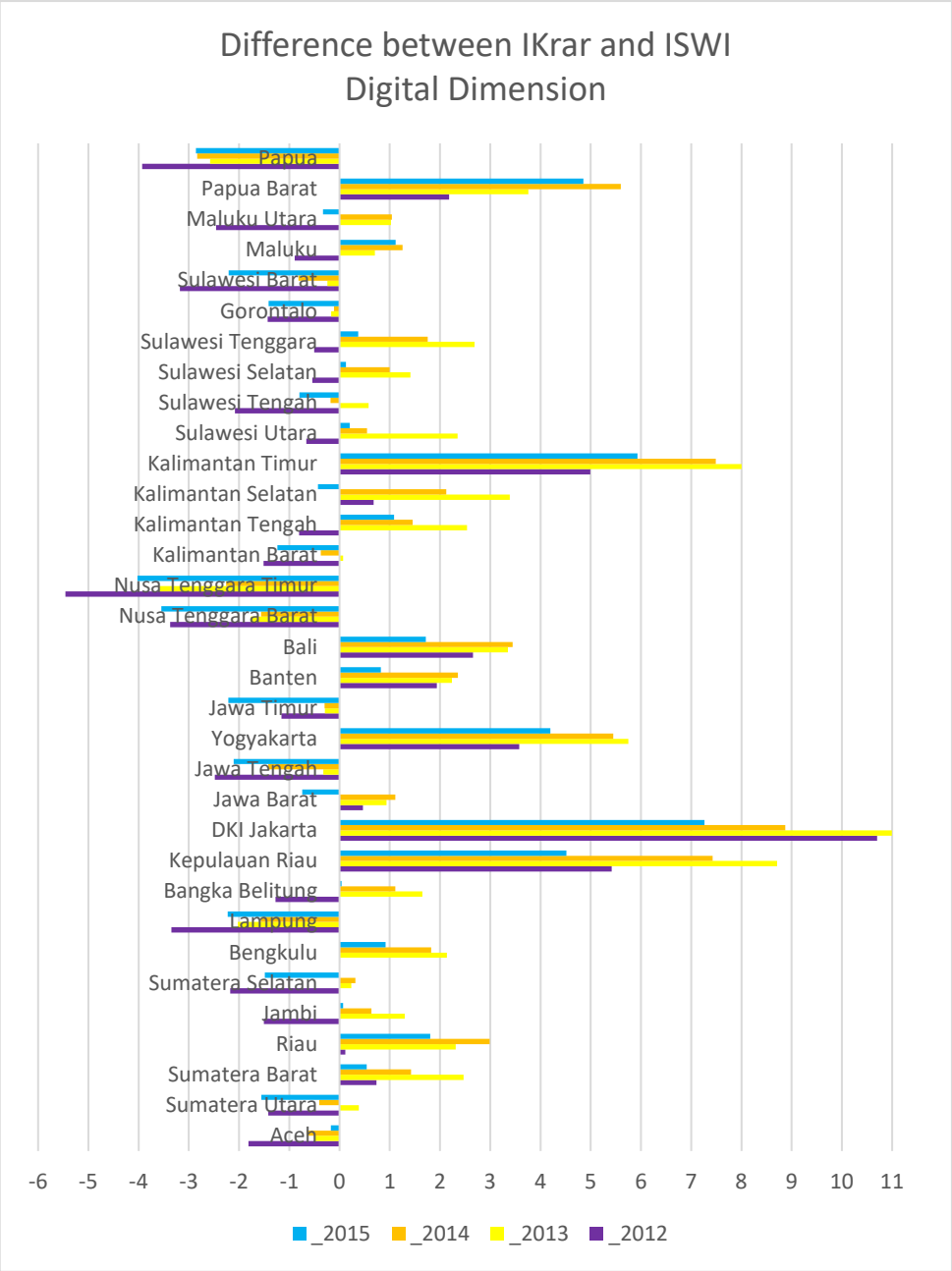


Figure 4. Gap between IKraR and ISWI Digital Dimension

Table 2. Proportion of cellphone, computer and cable phone owned

Region	Cellphone	Computer	Cable phone
INDONESIA	56.92	18.71	4.01

The table provides information about the proportion of households who have cellphone, computer, or cable phone. Because digital technology plays a major role in human development, Indonesia has to work on improving their own technology. According to Shade et al (2012), ICTs offer new possibilities for improved areas of human development such as health system, new ways of citizens' empowerment and active participation in the societies at both social and political levels.

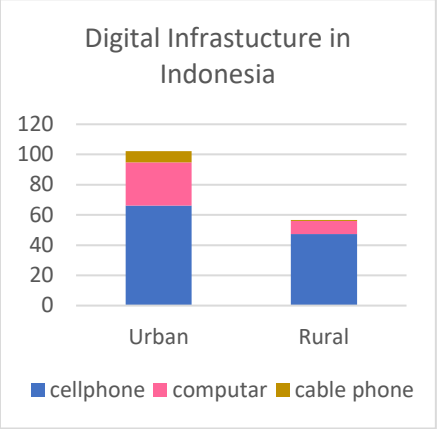


Figure 5. Digital infrastructure proportion in Indonesia

Besides, digital infrastructure ownership have not spread well enough. Shade et al (2012) shows that the impact of Information and Communication Technology (ICT) enhances learning and fills a large gap by encouraging distant learning; it is a suitable means of distributing and accessing learning resources which in turn have great learning potential in rural areas where resources such as books and libraries are scarce but ICT infrastructure is present. In contrast from that statement where ICT have an important role in rural areas, most of the infrastructures are actually developed in urban area. Indonesia is a massive islands country that requires various means of transportation in order to connect and access every region. This is quite a challenge for Indonesia to construct similar infrastructures and means of access for every region, even though having easy access can actually encourage people and their region to be more powerful. This fact was one of the reasons for wanting to provide an index that can accommodate and even accelerate the development.

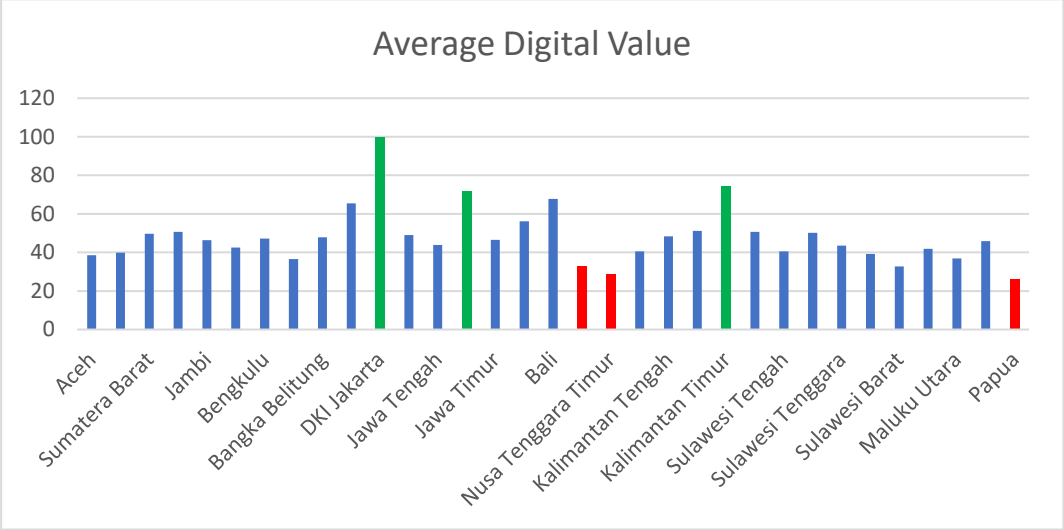


Figure 6. Average of digital value

DKI Jakarta, the capital city of Indonesia, has the highest value of digital infrastructure among others. As a metropolitan city which is well developed on digital infrastructure, its people can surely get any kind of access to economic, social, and politic facilities. The excellent digital infrastructure in DKI Jakarta gives a good impact to the citizen so they can improve themselves and make the region have the highest human development index among other provinces in Indonesia.

Digital infrastructure is important because it can be used to measure development in addition to allowing the citizens to easily get information—which actually has been stated in the Indonesian Constitution—like what happen in more developed countries. Guerriero, Marta (2015) concludes that Small and Medium-sized Enterprise (SMEs) are able to derive profits from the Internet as it enables companies to cut costs and increase revenues—in particular, they may gain benefit from improvements in communications, access to information and marketing. In addition, another positive impact of Internet connectivity on the SMEs sector is related to business creation. By enabling innovation, quicker diffusion of ideas and knowledge, and greater networking, the digital economy will allow access to new markets. Many governments and international agencies have widely recognized the relevance of furthering the access to the Internet especially in developing countries, where the potential marginal impact of enhanced network communications is still very high (Madon, 2000).

Evidence shows that poor and vulnerable people can be empowered by strengthening their capacity of receiving and using knowledge and helping them make more informed

decisions, with benefits in terms of social and financial inclusion, access to education and health, agriculture, governance and sustainable development (Broadband Commission, 2014b).

6. Expectation Dimension

According to Schmidt, Torsten and Vosen, and Simeon (2009), private consumption represents about 70 percent of US-GDP so timely information about private household spending is important to assess and predict overall economic activity. Due to the increasing popularity of the Internet, it is certain that a substantial amount of people also use web search engines to collect information on goods they intend to buy. Moreover, Google Trends is a very promising new source of data to forecast private consumption. Google also provides data for product searches specifically and discretely.

Choi & Varian (2009) have analyzed how Google Trend might help in predicting the present. This study illustrates some simple forecasting methods that use the existing data and encourage readers to undertake their own analysis. Based on this study, it is clear that Google Trends can serve as baselines to help analysts get started with their own modeling.

The Internet as an information medium is often used as a reference for people in order to decide on what kind of purchase they will do. Goel, Sharad, et al (2010) state that what consumers are searching for online can also be used to predict their collective future behavior days or even weeks in advance. Furthermore, Bortoli & Combes (2015) also believe that analyzing Google trending searches can improve the forecasting of household expenditure although only in limited ways. The increasing number of online shopping has encouraged the consumers to search for certain products before making a purchase. Basically, a person's desire to consume is related to their economic condition. Hence, people's desire to plan a purchase and their purchasing power can be used as an indicator on whether the economic condition in a region is good or not.

Schmidt, Torsten and Vosen, and Simeon (2009) shows that Google Trends is a very promising new source of data to forecast private consumption. Almost in all experiments conducted with the Google indicators' in-sample and out-of-sample, the predictive power turned out to be better than that of the conventional survey-based indicators. For a long time, statistics are collected using conventional methods. By using survey methodologies, researchers constructed representative samples to investigate topics of interest. In order to get useful information, the next steps usually include designing methodology, drafting a questionnaire to capture the necessary variables, collecting data, and then processing, analyzing

and disseminating it. These steps require a long time to complete. Sometimes further analysis and secondary supporting information are also needed to ensure the result.

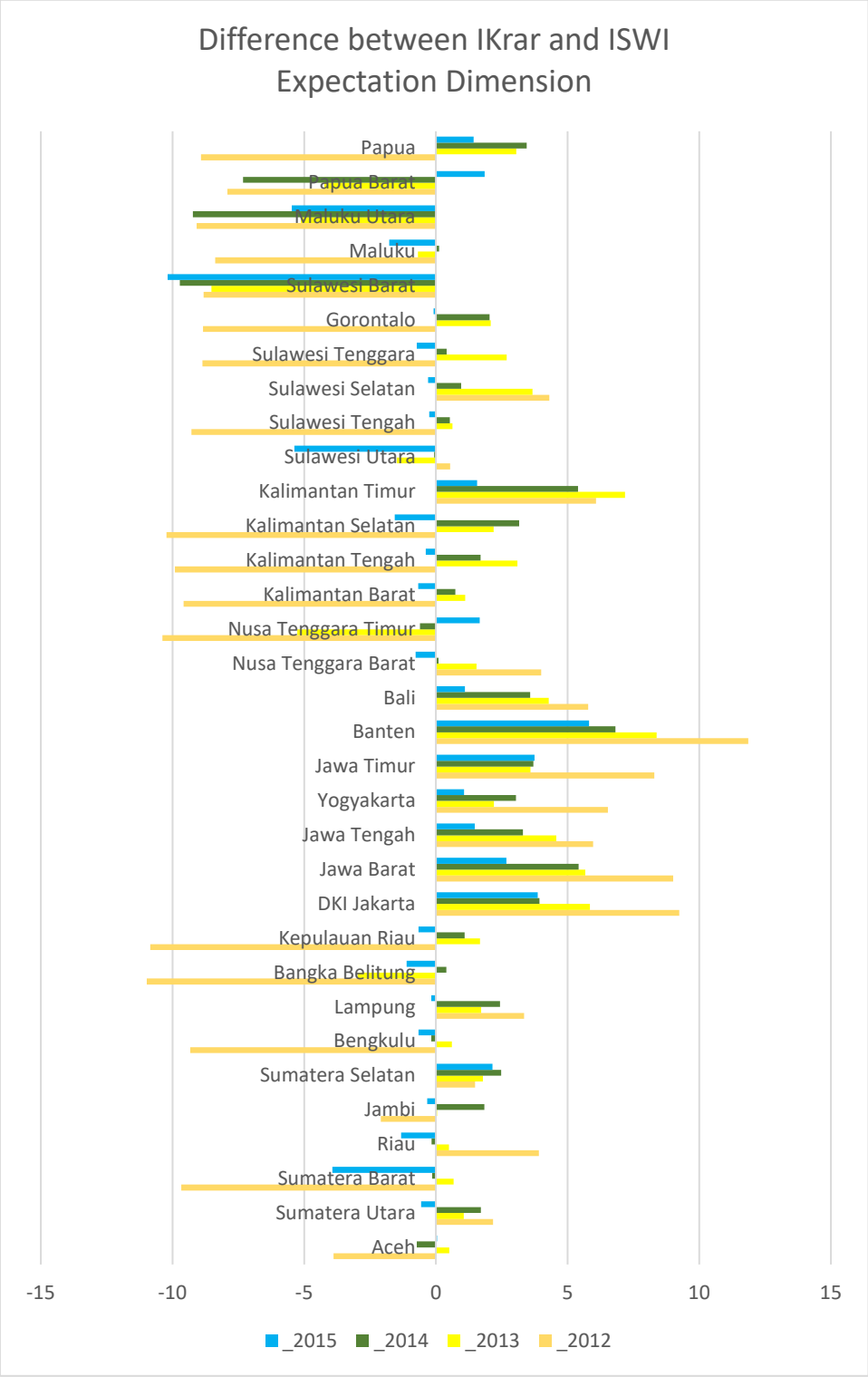


Figure 7. Gap between IKraR and ISWI Expectation Dimension

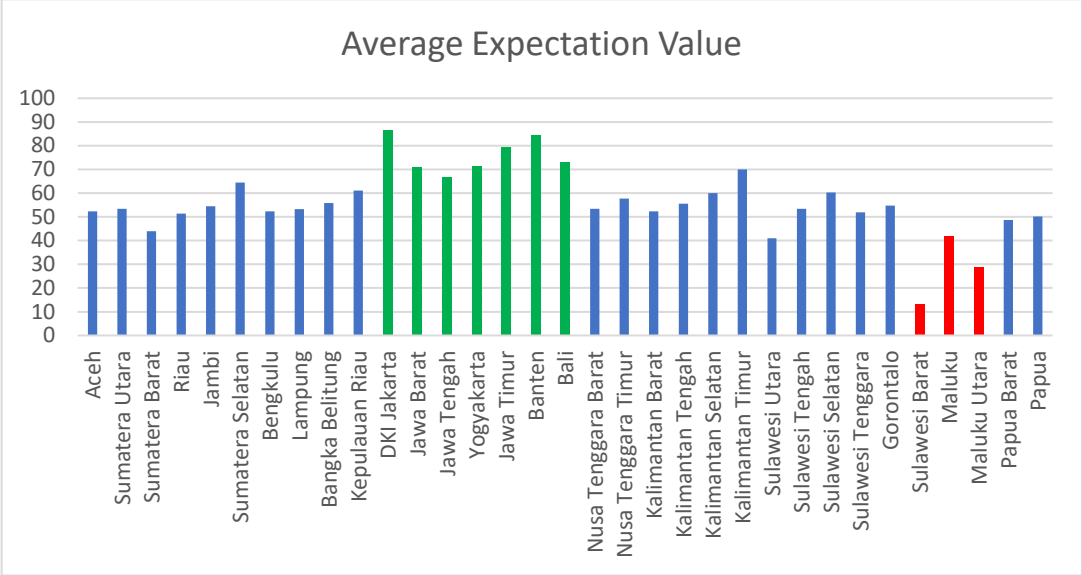


Figure 8. Average of expectation value

Based on previous SEM test, it can be concluded that the increase in Expectation Dimension is followed by the increase of IKraR Index. Regions with high expectation value (in green color) get a higher value than its IKraR index; whereas regions with low expectation value (in red color) get a lower value than its IKraR Index. The green bars present the regions in Java and Bali where the center of economic development is.

High individual expectation value shows that an individual believes that s/he has the ability to perform economic activities required in order to fulfill his/her primary as well as other kinds of needs. This confidence indicates their level of welfare, as stated by the Indonesian Ministry of Social Welfare. Welfare, after all, is also a process to improve the quality of life and the ability to achieve a life of dignity and independency.

7. Developing ISWI with scrapping online shop data

The growth of internet uses give impact to online activity, one of the is online shopping. The fast growth of online shopping and uncomplete registration provide a difficulties to conventional survey to get the data. But, the advantages of onlie shopping is the data is easily to get by analysing big data.

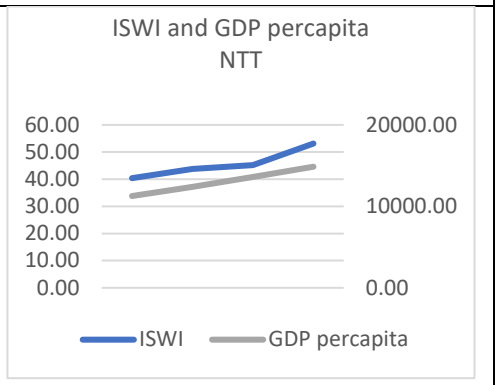
There are many kinds of the classification of e-commerce business model. Indonesia. E-Commerce Association (idEA) classified e-commerce business model in 3 types: Classified, Marketplace and Retail (Indonesian E-Commerce Association, (2016).) Suwiyanto and Siswahyu (2018) presents a new method for producing the time series data of e-commerce by using big data from several commercial sites in Indonesiausing Kapow® Software to conduct

indepth research crawling by capturing content of e-commerce site and collecting data to finally disseminate into database and provide output dynamic table.

Data from those web scrapping use as one of the variable in economycs dimension in ISWI. In the other hand, statistics by convensional surveys that is published by Statistics Indonesia (NSO) and and other related ministries has a lag time for publishing, the lag time average is around a year. For that reason, in order to establish ISWI 2018, the 2018 online shopping must be collected regularly throughout the year, but most of the statictics from convensional surveys at 2018 will be published at 2019. Because of those difference, ISWI that accomodate the online shopping variable has to be collected before at year occurence and statistics from other variables will be collected after its dissemination.

8. ISWI and GDP per capita

The ISWI and GDP per capita graphics show that ISWI does not always follow the GDP per capita trends. Currently, welfare measurement is dominated by economic factors such as economic growth, inflation rate, and investment level. Although the GDP per capita indicates a positive growth, it does not mean that it will be followed by the increase of welfare. After all, GDP can be biased when it merely talks about a small number of people and their contribution.

The Biggest GDP	The Lowest GDP
	

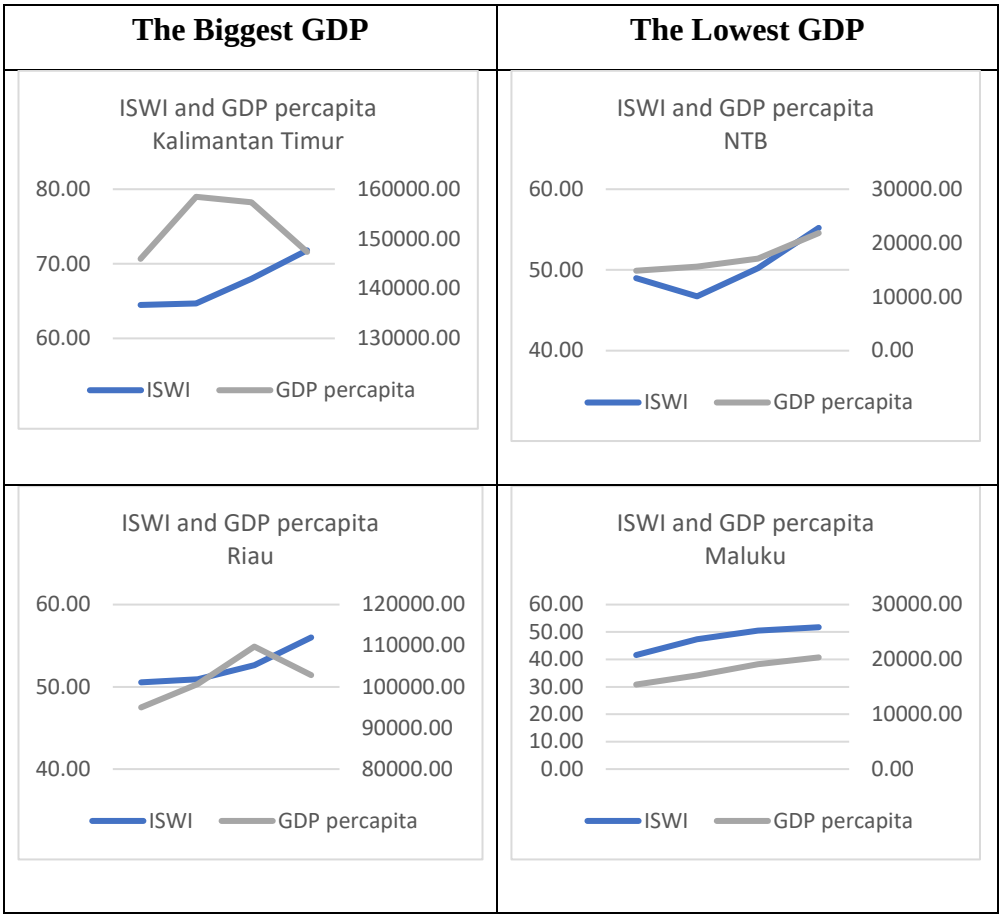


Figure 9. Comparison between ISWI and GDP per capita

V. Conclusion

This study establishes the Indonesia Sustainable Welfare Index (ISWI) method, which can be used to assess economic welfare in Indonesia in the digital era in addition to fulfilling the objectives of SDGs. It does not only use statistical data from NSO, but also explores the Big Data from Google Trends in order to accommodate the effect of digital era on welfare. Moreover, ISWI does not only contain social dimension, economic dimension, and government dimension that have been theoretically tested, widely accepted and implemented in Indonesia since 2012, but it also includes the environmental dimension, digital dimension, and expectation dimension that have also been theoretically and statistically tested. The indicators and dimensions used in ISWI represents Indonesia's people welfare. The present indicators would try to accommodate various indicators that are used to evaluate country's development. Regions that are capable of balancing between increasing the environmental quality and continue progressing in the field of social,

economic, government, digital and expectation will experience an increase in the ISWI index value.

Evaluation of SEM analysis concludes that the improvement of current welfare is not followed by the increase of environmental quality. However, the changes caused by digitalization and level of people's desire to consume have positive effects to the welfare. They encourage the need to establish a method of assessing the welfare index which also accommodates the levels of environmental quality and digital effects.

ISWI's Social Dimension uses indicators related to the provision of basic needs and public access. They can serve as a guide for policy makers at central and regional government, encouraging improvements in the provision of service, improvement of access, and reduction of social inequality in the community. Additionally, the economic dimension is more about the progress of indicators that reflect people's ownership and access to economic resources to achieve their welfare. While the Dimension of Democracy and Governance is a measurement of people's welfare by taking into account the progress of democratic development that guarantees the rights of the people to participate in the democracy process independently and with no discrimination.

The purposes of Environmental dimension is to prevent the loss of welfare of the population, especially for future generation, as a result of the degradation of environmental quality. Based on BPS (Statistics Indonesia), Environmental Quality Index is measured by the quality of river water, air, and forest cover which have been statistically tested. However, development that only pursues growth without any regard to environmental sustainability is futile because future generations also have the same rights as the generation that lives today.

ISWI proposed the digital dimension to be added in consideration of the digitalization effect on welfare. Digital infrastructure is important because it can be used to measure development that allows citizens to easily acquire information—which actually has been stated in the Indonesian Constitution—like what happen in more developed countries. In addition, digitalization has also caused a number of improvements in various sectors, such as the SMEs' growth and profits, giving benefits in terms of social and financial inclusion, and improving access to and/or in education, health, agriculture, governance, and sustainable development. The digitalization era enables the big data analysis to be used in welfare calculation, and in this study it is specifically used for developing expectation dimension. The individual expectation dimension indicates

individual's belief in his/her ability to perform economic activities required in order to fulfill his/her primary in addition to other kinds of needs.

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VII. Annex

A. Structural Equation Modeling (SEM)

According to Byrne (2010), Structural Equation Modeling (SEM) is a powerful collection of multivariate analysis techniques, which specifies the relationships between variables through the use of two main sets of equations: Measurement equations and structural equations. Measurement equations test the accuracy of proposed measurements by assessing relationships between latent variables and their respective indicators. The structural equations drive the assessment of the hypothesized relationships between the latent variables, which allow testing the statistical hypotheses for the study. Additionally, SEM considers the modeling of interactions, nonlinearities, correlated independents, measurement error, correlated error terms, and multiple latent independents each measured by multiple indicators.

B. Developing robot using Kapow® - Kofax

- Design of Google Trends Database

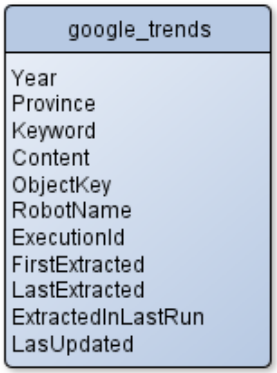

Figure 10. Design of Google Trends Database

- Flowchart of Collecting Google Trends Data Using Kapow® - Kofax

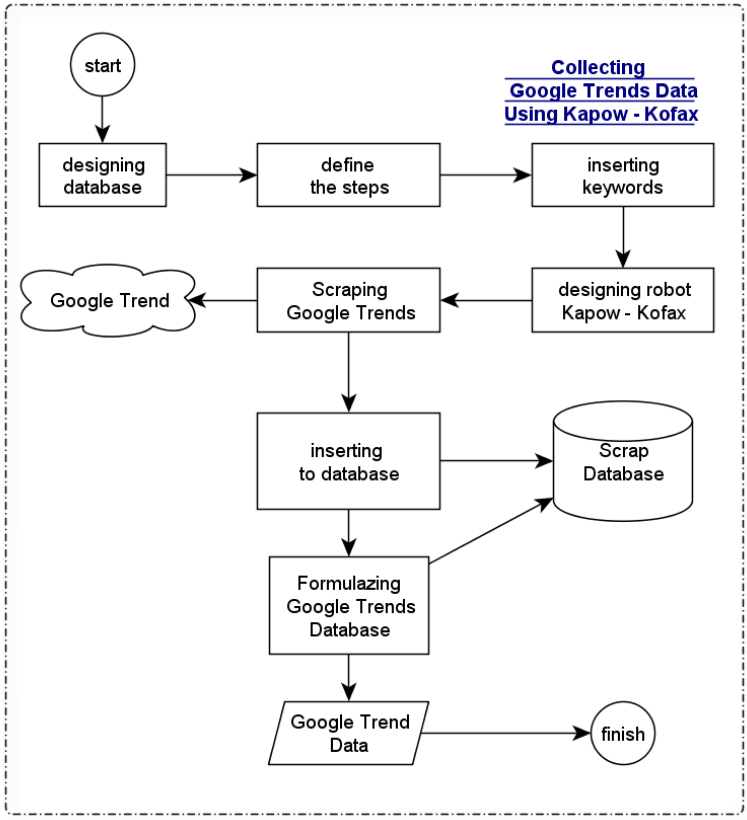

Figure 11. Flowchart of Collecting Google Trends Data Using Kapow® - Kofax

C. Scraping Google Trends Data

Results | Messages

	Year	Province	Keyword	Content
1	2015	Maluku Utara	yamaha	NULL
2	2015	Kalimantan Timur	honda	42
3	2015	Nusa Tenggara Timur	sepeda motor	96
4	2015	Sulawesi Selatan	mobil	74
5	2015	Papua Barat	sepeda motor	92
6	2015	Kalimantan Barat	mobil	54
7	2015	Bali	honda	40
8	2015	Lampung	honda	39
9	2015	Sulawesi Barat	yamaha	NULL
10	2015	Kalimantan Tengah	mobil	71
11	2015	Sulawesi Tenggara	mobil	44
12	2015	Jambi	sepeda motor	28
13	2015	Jambi	honda	39
14	2015	Jawa Tengah	mobil	72
15	2015	Riau	honda	33
16	2015	Sulawesi Tenggara	honda	31
17	2015	Banten	honda	54
18	2015	Kalimantan Utara	sepeda motor	NULL
19	2015	Daerah Khusus Ibukota Jakarta	honda	62
20	2015	Sulawesi Tengah	honda	38

Figure 12. The Process and result of Scraping by Kapow – Kofax

Google Trend data that is collected by building a robot, is stored into a database and be transformed into data.

D. Keywords

Table 3. Keyword for Scraping Google Trends Data

Transportation	**Recreation**	**Investation**	**Digital**	**Household applicants**
(1)	**(2)**	**(3)**	**(4)**	**(5)**
mobil	cineplex	emas	iphone	TV
sepeda motor	cinema21	Rumah dijual	xiaomi	Mesin cuci
honda	cinemax	rumaholx	vivo	Air conditioning
yamaha	blitz	rumahcom	oppo	kulkas
mitshubishi	karaoke	rumah123	asus	Lemari es
toyota			samsung	televisi
daihatsu			sony	
Mobil suzuki			apple	
jual mobil			dell	
jual sepeda motor			toshiba	
			lenovo	
			acer	

E. PLS Testing Results

Table 4. PLS Testing Results

Dimension	**Indicators**	**T-Statistics**
Digital	**dig_cable_phone**	32,925
	dig_cellphones	90,143
	dig_computer	75,933
Environment	**env_air_quality_**	13,419
	env_indeks_land_cover_	19,754
	env_indeks_water_quality_	4,132
Expectation	**ten_itk3**	2,298
	ten_ppp	19,535
	trend_digital	12,572
	trend_house	39,681
	trend_investment	45,983
	trend_recreation	16,487
	trend_transport	29,673

With a 95% confidence level, it can be concluded that all of these indicators are significant because they have a t-value of more than 1.96.

Table 5. Path coefficient and T-Statistics

Dimensions	Path coefficient	T Statistics
digital	0,434019	4.577897
environment	-0,184938	2.682472
expectation	0,387550	4.968322

The table provides information that three dimensions are significant because they have a t-value of more than 1.96.

Table 6. Loading Indicator Factors and the proportion in each dimension

Dimension	**Indicator**	2012		2013		2014		2015	
		Value	**Prop.**	**Value**	**Prop.**	**Value**	**Prop.**	**Value**	**Prop**
Social	ikr_ds_water_	0.6708	0.1366	0.5437	0.1053	0.7110	0.1456	0.8363	0.2179
	ikr_ds_toilet_	0.7457	0.1519	0.8522	0.1651	0.7157	0.1465	0.6745	0.1758
	ikr_ds_p0	0.7008	0.1428	0.3230	0.0626	0.3865	0.0791	0.8086	0.2107
	ikr_ds_gini_n	0.0602	0.0123	0.1041	0.0202	0.0690	0.0141	0.1770	0.0461
	ikr_ds_electricity_	0.4457	0.0908	0.4284	0.0830	-0.0315	0.0064	0.2630	0.0685
	ikr_ds_care_	0.3134	0.0638	0.7700	0.1492	0.7260	0.1486	0.3723	0.0970
	ikr_ds_recreation_	0.5066	0.1032	0.6489	0.1257	0.7008	0.1435	-0.2932	0.0764
	ikr_ds_mys_	0.3141	0.0640	0.7673	0.1486	0.5819	0.1191	0.0004	0.0001
	ikr_ds_jamsos_	-0.4282	0.0872	-0.4373	0.0847	0.1332	0.0273	0.1850	0.0482
	ikr_ds_e40_	0.7234	0.1474	0.2869	0.0556	0.8285	0.1696	0.2274	0.0593
Economy	ikr_de_home_	0.7599	0.2653	-0.5462	0.1659	-0.7636	0.2117	-0.8348	0.2782
	ikr_de_work_	0.5838	0.2038	0.6476	0.1967	-0.2910	0.0807	-0.4333	0.1444
	ikr_de_expgk	-0.1920	0.0670	0.1245	0.0378	0.7981	0.2212	0.8588	0.2862
	ikr_de_pad	0.1782	0.0622	0.7978	0.2424	0.6644	0.1842	0.5744	0.1914
	ikr_de_bank_	0.2433	0.0850	0.1334	0.0405	-0.2394	0.0664	0.0846	0.0282
	ikr_de_shstudall	-0.1322	0.0462	0.4808	0.1461	0.2481	0.0688	0.0427	0.0142
	ikr_de_shheall	-0.7746	0.2705	0.5615	0.1706	0.6028	0.1671	-0.1721	0.0574
Government	ikr_dp_inet	0.6904	0.2685	0.6132	0.2561	0.8159	0.3477	0.7567	0.2828
	ikr_dp_crime	-0.3512	0.1366	0.0565	0.0236	-0.2045	0.0871	-0.3185	0.1190
	ikr_dp_civil_	0.2990	0.1163	-0.3385	0.1414	0.1542	0.0657	-0.0432	0.0161
	ikr_dp_politic_	0.7979	0.3103	-0.6045	0.2525	0.6789	0.2893	0.7953	0.2972
	ikr_dp_lemdem_	0.4328	0.1683	0.7812	0.3263	-0.4930	0.2101	0.7623	0.2849
Environment	env_air_quality_	0.8537	0.4727	0.7120	0.3870	0.8225	0.4222	0.7482	0.3359

Dimension	Indicator	2012		2013		2014		2015	
		Value	**Prop.**	**Value**	**Prop.**	**Value**	**Prop.**	**Value**	**Prop**
	env_indeks land_cover_	0.8469	0.4690	0.8146	0.4427	0.8516	0.4371	0.7379	0.3312
	env_indeks water_quality_	0.1053	0.0583	0.3135	0.1703	0.2741	0.1407	0.7416	0.3329
Digital	dig_cellphones	0.7803	0.3056	0.8510	0.3917	0.8559	0.4293	0.8363	0.4515
	dig_computer	0.9246	0.3621	0.8687	0.3999	0.8308	0.4167	0.8364	0.4515
	dig_cable_phone	0.8487	0.3324	0.4527	0.2084	0.3072	0.1541	-0.1798	0.0970
Expectation	ten_itk3	0.4371	0.0881	0.2839	0.0828	-0.0488	0.0122	0.5279	0.1369
	ten_ppp	0.1095	0.0221	-0.0725	0.0212	0.4885	0.1216	0.4086	0.1059
	trend_transport	0.9733	0.1963	0.6166	0.1798	0.7307	0.1819	0.4942	0.1281
	trend_recreation	0.7854	0.1584	0.5578	0.1627	0.8411	0.2094	0.6318	0.1638
	trend_digital	0.9730	0.1962	0.5353	0.1561	0.7300	0.1817	0.6069	0.1573
	trend_house	0.9278	0.1871	0.7369	0.2149	0.6112	0.1522	0.6407	0.1661
	trend_investment	0.7530	0.1518	0.6261	0.1826	0.5665	0.1410	0.5469	0.1418

Figure 13. The second order structural equation modelling (SEM) using Smart PLS.