Interdisciplinary Policies Reform on Scientific Innovation, Technological Innovation and Economics innovation for Sustainable Economic Development

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Abstract. The world is facing many problems which come from the effects of the scientific science innovation, technological science innovation, and economics science innovation. These all innovations affect on the sustainable economic development. People all over the world pertain over consumption on products and services and lead to the exhaust of resources and factor of productions. Consequently, this over consumption creates negative effect to the world temperature and lead to the global warming problem together with the natural disaster. In the same time innovation from the economics science have create financial crisis and economic downturn in many country. To cove with these problems, government in every country must have their public policies reform in many areas to revitalize and sustain the economic growth and economic development in each country.

Keywords: Interdisciplinary policies reform, innovation, cooperatives, sustainable economic development

1. Introduction

This paper elaborates that to create and to maintain the sustainable economic development (economic growth, economic stability, economic equity and competitive within cooperatives) for every country is crucial. There are four major factors, two of them are the external factor, the global warming and natural disaster, the other two are internal factors, financial crisis and economics downturn. These four factors create variation to the economic development.

The global warming and natural disaster partly come from the advantage discovery of scientific innovation and technological innovation. From these two area of innovations, the world had turn into the over consumption of both natural resources and factor of production and finally create global warming and natural disaster. The parallel obstacle is the over consumption of consumer, private sector and government expenditure, which finally create financial crisis and economic downturn. These four problems therefore are the obstacles to the sustainable economic development of every country.

The effective approach to solve the above four problems is the appropriate public policy reform by the government and the public sector. This paper elaborates three types of variables influencing on the sustainable economic development which is the dependent variables. Firstly is the group of six independent variables: a) scientific science innovation and policy reform, b) political science innovation and policy reform, c) economics science innovation and policy reform, d) business science innovation and policy reform, e) legal science innovation and policy reform, f) educational science innovation and policy reform. Secondly is the group of intervening variables: a) over population growth, b) over consumption and financial problem, c) over use of resources, d) over use of energy, e) natural disaster, f) food security and energy crop, g) environmental decay. Thirdly is the group of moderating variables: a) knowledge management network, information management network, technological management network, and innovation management network.¹

2. Literature review

Currently, the world is facing four big problems: two problems are come from the over consumption of resources and factors of production, finally create global warming and natural disaster in many parts of the world. The other two problems are financial problem and the economic downturn. These all four

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problems had come from the inappropriate use of innovation and inappropriate policy formulation. Among those they are: inappropriate use of scientific science innovation and it policy formulation, inappropriate use of political science innovation and it policy formulation, inappropriate use of economics science innovation and it policy formulation, inappropriate use of business science innovation and it policy formulation, inappropriate use of legal science innovation and it policy formulation, inappropriate use of educational science innovation and it policy formulation. These six inappropriateness problems are the independent variables effects to the countries sustainable economic development which is the dependent variable.

Not only the six independent variables, but there also the seven intervening variables: over population growth, over consumption and financial problem, over use of resources, over use of energy, natural disaster, food security and energy crop, and environmental decay. Apart from the seven intervening variables, there are other four moderating variables: knowledge management network, information management network, technological management network, and innovation management network.

2.1 Dependent variable: Sustainable Economic Development
Sustainable economic development is the ultimate goal of the economy. It consists of four kinds of measurements: economic growth, economic stability, economic equity, and competitive within cooperatives.

2.1.1 Economic growth
The Neoclassical economist proposed that the economic growth model accounts for growth in output as a function of growth in inputs, particularly capital and labor, labor is the most important input for the economic growth. The relative importance of each input depends on its factor share. This is the same as the meaning of economic growth as the increases in a country’s production or income per capita by W. Arthur Lewis (1955). These two similar definitions are under the type of exogenous growth which ignores technological advancement and concentrate on only the economic policy that affecting growth.

In the opposite way the endogenous model of economic growth depend on technological progress while the technological progress depend on saving, and saving depend on human capital. The endogenous economic growth model therefore concentrate both on the economic and social policy that affecting growth (N. Gregory Mankiw 1995).

The right way of the economic growth should come from the two models mix together the exogenous and endogenous factors. Therefore, “economic growth” is a measurement of the dependent variable.

2.1.2 Economic stability
Economic stability is a condition in which output is steady or growing with low inflation and full employment of resources. In the opposite way, the economic instability is the economic situation with the fluctuation in output growth, or fluctuation in financial market, product market and factor market. The half way of the ultimate goal of the economic development is the economic growth with its stability. Therefore, the economic stability is a measurement of the dependent variable.

2.1.3 Economic equity
The third step of the macroeconomic policy is the economic equity, equity is fairness. Fairness implies a more distribution of income and wealth. Despite the impossibility of equity or fairness universally, public policy makers judge the fairness of the economic outcome all the time. Certainly, most social welfare programs are created in the name of equity. A country with the economic equity will come out with the mutual prosperity. Thus the “economic equity or income distribution is a measurement of the dependent variable.

2.1.4 Competitive within cooperativeness
The economic theories science model had developed from time to time, but all of that are involved in capitalism.
From mercantilism to capitalism: Adam Smith 1776
The economic world had developed from the mercantilism era during 1500-1800. Many countries in Europe try to acquire and accumulate their asset and wealth. In this period, Adam Smith (1776) had wrote two books: the first one is the Morale of the Sentiment but nobody read it, most of people read the second one “An Inquiry into the Nature of the Wealth of Nation” this book suggest that country with the more capital will be the one who have the absolute advantage over other countries. Therefore, the government of every country whose adopt this theory will follow the capitalism system. This period is so called, from mercantilism to capitalism.

From Absolute advantage to comparative advantage: David Ricardo 1817
Up to 1817, David Ricardo wrote a book named “The Principle of Political Economy and Taxation”, this book proposes the “Comparative advantage of Nation” this concept suggest that capital is not only the factor to create the advantage to the country, but there are some other factors can established the advantage to the economy such as skill or technology. Any country whose can produce with more efficient than another country can have more advantage by comparative or we call it “The comparative advantage”. This period is so called from Absolute advantage to the comparatives advantage.

The starting of cooperatives advantage: Robert Owen 1813
In 1813, Robert Owen had wrote a book named “A New View of Society: Essays on the Principle of the Formation of the Human Character, this book then expanded in a number of pungent essays, particularly Report to the Country of Lanark (1821). He is the founder of cooperatives communities. He believes in the value of cooperation rather than the competition. Until 1848, his idea had coupled with St-Simon and Charles Fouries of transforming self-interest into a concern for others.

The cooperatives movement of the cooperatives firms are trickle down up to date to this 2012 which the United Nation had proclaim this year to be the “International Year of Cooperatives”. Most people feel that the capitalism is the cause that creates the global warming, natural disaster, financial problem, and economic downturn. Eventually we have a question that the pro on the economics efficiency is correct or the pro on the economic equity is the root of the sustainable economics development.

The starting of Excess Aggregate Demand Management: John Maynard Keynes 1936
To escape from the great depression in the United of America in 1929, with “The General Theory of Employment, Interest and Money (1936), John Maynard Keynes gave the suggestion to the U.S government to encourage the consumption in the demand side of the economy. From his suggestion, the U.S. government increases the government expenditure by inject more budget or the so called deficit budget or expansionary fiscal policy to increase the aggregate demand into the economy. With the multiplier effect, this concept success in produce the higher level of consumption into the economy. This aggregate demand is what we admire Keynes is the father of the macroeconomics or theory of “Demand management”.

At that time, most of people think that only John Maynard Keynes who can stand next to Adam Smith and David Ricardo. But nowadays the demand management of Keynesian is too active to the whole economy. The whole economy is facing with the excess demand of over consumption, over private investment and over government expenditure. This excess demand in every market in the same time had created the risk and variation to the economy. Finally, we had the financial market problem and the economic downturn.

From the above perspectives, we can summarize that every country should have the cooperatives more than competitive. The mutual benefit is better than individual country benefit. But in the reality, they still never happen. Therefore the competitive within cooperatives is a measurement of the dependent variable.

2.2 Independent variable 1: Scientific science innovation and policy reform
There are many scientific science innovations such as: super grid technology, space transportation system, satellite, etc. The scientific science itself has make no mistake, the innovation from the discovery of scientific science and its innovation does not make any false but the falseness are come from the policy maker.

An example of the scientific science innovation is the world higher temperature. The scientist had discovered for long time about the affect of the CFC, green house effect, etc. but nobody listen to that voice and still use, consume, and produce all that all affects to the world. This included the global warming and natural disaster.

Thus, it is the time for the public policy maker to avoid to increasing the level of global warming. This is the direct responsibility of the government and the politician to encourage their people to reduce global warming. Therefore the problem of environmental decay will affect to both economic and social.

Due to the above problems, a) the scientific science innovation and scientific policy reform, b) the reducing of the global warming and c) the diminishing of the natural disaster, are the three measurements of the first independent variable.

2.3 Independent variable 2: Political science innovation and policy reform
Apart from the scientific science innovation, the political science innovation and the political policy formulation is the second concern. The public policy that effect to the sustainable economic development has three levels, at the international level we have the United Nations policy, at the national level we have the governmental policy. These two levels of policies will be work well or effective must have a good governance aspect. Thus the United Nations policy, the national government policy and politician good governance is the three measurements for the political science innovation and policy reform.

2.4 Independent variable 3: Economics science innovation and policy reform
The economic science innovation and policy reform is the direct factor to the sustainable economic development.

2.4.1 Economics science innovation
Under the economics context, the innovation of this science had developed from the absolute advantage to the comparative advantage and from comparative advantage to the cooperative advantage. But when such innovation had transformed to be the invention, it has too much of commercialization aspect more than optimization aspect. Finally, it creates problems to the world.

Since the traditional economic science believe in the maximizing profit and consume too much resource and incur directly the global warming and natural disaster, while financial problem itself impact indirectly and lead to the economic downturn. The economist have to be more careful in the future when they discover their new innovation, they have to nurture their innovation to transform to produce the appropriate invention and not to expect too more of benefit from commercialization. Thus the economic science innovation is an independent measurement to explain the dependent variable.

2.4.2 Economic policy reform
As the above reason in 2.4.1, it is the time for the paradigm shift from the profit maximizing concentration to be the optimizing profit. The profit maximizing concept had led the world into the way of over consumption and over demand on the natural resource and factor of production. To adjust ourselves from the maximizing profit and highest return concentration to the optimization are depend on many factors. Therefore, the “not for maximization” is an appropriate measurement to assess the sustainable economic development.

2.4.3 Income distribution
Income distribution is the third step of macroeconomic goal of the classical school, but E.F Schumacher had proposed the Sufficiency Economy theory in 1973 and one year later, King Bhumipoladulyadej of
Thailand had proposed the philosophy of sufficiency economy in 1974. These two theories had parallel together to explain the optimum use of optimum scale of economic policy and stress on the income distribution more than the economic growth. Therefore, the income distribution is a independent measurement to the dependent variable.

2.5 Independent variable 4: Business science innovation and policy reform

Within the business science area, the business academician theorist believes in the profit maximization of the owner or the producer of the firm. During the 1900 to the 2000, the concept of the Marketing discipline was formed up, the first of the marketing subject was established in the University of Wisconsin and to be nurtured at the University of Harvard. The discipline of Economic had give a birth of the discipline of business and marketing. Therefore the business science innovation and policy reform is an independent variable.

2.5.1 Business science innovation

An example of the business science innovation is the three discovery of the competitive advantage by Michael E. Porter in 1980, 1985, and 1990.

In 1980, Michael E. Porter had constructed his book “The Competitive strategy: Technique for Analyzing Industries and Competitor. This book proposed that in order to enter to the market, the management of the firm have to analyze the density of the rivalry in the industry. The four factors that determine the density of the rivalry level are depend on the threat of new entrant or number of new entries, the second factor is the number of substitute produce that can be substitute to our firm products and services. The third and fourth factors are the bargaining power of supplier and customer or buyer. These four factors are aggregate influence the density of the rivalry in such industry. This is the first innovation of Porter at the industry level which so called “The Five Force Model [3]”.

In 1985, Michael E. Porter had constructed one more book “The Competitive Advantage: Creating and Sustaining Superior Performance”. This book elaborates that every firm have to explore their firm strength and weakness, which come from two sources of factors within firm: firstly is the primary activity and secondly is the supportive activities. The primary activities are their a) inbound logistics, b) operation c) outbound logistic, d) marketing and sale, e) service. The supportive activities are their a) infrastructure interrelation between firm infrastructure and human resource management or what we call the organizational structure side and the human side of the firm. The other two are the technological development interrelations among every department of the firm, and the interrelations of procurement among every department of the firm. These two groups of activities blend together will generate the firm margin and the as much as margin the firm gain from their business is the superior performance of the firm which is come from their value chain. This is the second innovation of Porter at the firm level which so called “The Value Chain Model [4]”.

In 1900, Michael E. Porter had construct one more book “The Competitive Advantage of Nation”, There are six dynamic factors influencing on the nation competitive advantage. They are a) demand conditions, b) factor conditions, c) firm strategy, structure, and rivalry, d) related and supporting industry, e) business chance, and f) government. In this model we can see that Porter identify both external factor which is business chance and government and the rest are the internal factors. In this model, Porter point out the government intervention which make this model at the national level. Therefore this third innovation of Porter is a part of competitive advantage innovation, he call it, “The Dynamic Diamond Model”.

From the above porter’s model, we can summarize that the “business science innovation” is a measurement of independent variable to measure the dependent variable.

2.5.2 Business policy reform: not encourage consumption
From 2.5.1, we can see that all of the Porter’s theories are concentrated on the sale volume and firm have to try to encourage consumer consumption. In the marketing discipline, the marketing scholars also cooperate with the businessmen to encourage customer to be buyer by a big volume of advertising budget, especially the era of social media. The economists themselves try to encourage consumer to be the buyer in the market place under many types of market structures. These all policies of businessmen and economists are encouraging and concentrating the consumption. Therefore, “Not encourage consumption” is a good measurement of the business policy.

One more factor to be a good measurement is the “Corporate governance” policy which will make the business area have more transparency, more accountability and not create subprime loan or any financial failure as occur in some countries.

### 2.6 Independent variable 5: Legal science innovation and policy reform

This variable has two parts: one is the legal science innovation and the other is the legal policy reform.

#### 2.6.1 Legal science innovation

A major independent variable to explain the sustainable economic development. Since the increasing of the global affects come from the excess demand, loosely structure rule and law, and code of conduct or commercial laws are still needed and have to readjust.

An international innovation from the legal science is the discovery of pollution tax, which will make the cost to do business, increase and produce some burden to the private sector. But this approach is to limit the negative effects to the society. Thus the legal science innovation is an independent variable of the model.

#### 2.6.2 Legal policy reform

Since the legal policy is a must to protect the environmental decay, pollution construction. It is a process that legal can stimulate the sustainable economic development. The government of every nation must maintain the legal transparency and accountability together with the regional governance network to save the world to have the green economy.

### 2.7 Independent variable 6: Educational science innovation and policy reform

The last disciplinary to create sustainable economic development is the education science innovation and its policy reform.

#### 2.7.1 Educational science innovation

There are many education science innovations that create advantage to our day of life, for example, the primary study for children, the life long learning for adults, the vocational school for many professions, and many other careers. Educational science in the traditional period are mostly only teaching and learning, but nowadays, the educational science had adjust itself for hundred of years. “There are not only for normal people, but also the handicap people. Thus, it is the time to adopt all innovation in all of scientific science innovation and it public policy reform, political science innovation and it public policy reform, economics science innovation and it policy reform, business science innovation and it policy reform, and the legal science innovation and it policy reform to include in the national education system for the human resource development in each country. Thus, educational science innovation is a measurement of the independent variable to assess the dependent variable of the model.

#### 2.7.2 Educational policy reform

In the same time, the education policy reform have to occur in many area of education, this include the “curriculum reform” which have to up to date and matching to the “school and society” of national cultures. Thus, the educational policy reform is a part of the six independent variables.

### 2.8 Intervening variable: Global purifier

An intervening variable is one that surfaces between the time the independent variable operate to influence the dependent variable and its impact on the dependent variable. An intervening variable is both a product of the independent variable and a cause of the dependent variable. The intervening variable surfaces as a function of the independent variable(s) operating in any situation, and helps to
conceptualize and explain the influence of the independent variable(s) on the dependent variable. Unlike the moderator variable, all categories of the intervening variable affect all categories of the dependent variable. In this study, we found that there are seven intervening variables influence the relationship between the independent and dependent variable, they are as the following.

2.8.1 Over population growth
Population growth rate is the first cause to make higher rate of consumption of resources and factor of production and create a lot of wastes or garbage to the globe. Therefore, the “over population growth” is a significant measurement to interrupt the relationship of the model.

2.8.2 Over consumption & financial problem
Due to the over population growth, it must follow by the over consumption and financial problem from the excess demand of the economy in both the product market and financial market. Therefore, the over consumption & financial problem is a significant intervening variable in the model.

2.8.3 Over use of resources
This is an explicit problem of the world. We are facing with the many exhausted resources case and try to control this problem for many years. But our intentions still got less cooperation from our world population. The over use of resource thus is a significant intervening variable to the model.

2.8.4 Over use of energy
This is a cause of global warming and it is a significant intervening variable to the model. Currently, the world population had consumed and destroy much energy, for example crude oil, gas, mineral, etc., and the negative effects of them are the world high temperature, global warming, and natural disaster. Therefore, the over use of energy is a significant intervening variable of the study.

2.8.5 Natural disaster
This is a highly significant intervening variable of the model, it intervene the relationship between the independent variable and dependent variable of the study. The more number of the natural disaster the less of the growth rate of the gross domestic product (GDP).

2.8.6 Food security and energy crop
Food security is also an intervening variable to the model. Since the global warming occur, this natural variation of temperature had decreased out put of food product and affect food safety problem. Apart from the shortage of supply, it is also a problem affect to our food security is the objective of the crop production for energy. This policy might make the scarcity of food more serious. Therefore, the food security and energy crop is also an intervening variable.

2.8.7 Environmental decay
According to the amount of the resource that has been used and consume everyday, the economy had produce lots of decay in our environment. Therefore, the environmental decay is a significant intervening variable.

2.9 Moderating variable: management network of knowledge, information, technology, and innovation
A moderating variable is one that has a strong contingent effect on the independent-dependent variable relationship. The moderating variable modifies the original relationship between the independent and the dependent variables, in that, the relationship holds true for some categories of the sample but not for other categories (Robert, Brian, and Uma: 2001) [5].

There are four kinds of moderating variables in the model. They are a) Knowledge management network, b) Information management network, c) Technology management network, and d) Innovation management network. Among these four moderating variables, the innovation management is the most interesting to the model, because the knowledge plus information and technology will result in an innovation.
Innovation management is the discipline of managing processes in innovation. It can be used to develop both product and organizational innovation. Without proper processes, it is not possible for R&D to be efficient; innovation management includes a set of tools that allow managers and engineers to cooperate with a common understanding of goals and processes.

The focus of innovation management is to allow the organization to respond to an external or internal opportunity, and use its creative efforts to introduce new ideas, processes or products. Importantly, innovation management is not relegated to R&D; it involves workers at every level in contributing creatively to a company's development, manufacturing, and marketing. By utilizing appropriate innovation management tools, management can trigger and deploy the creative juices of the whole work force towards the continuous development of a company. The process can be viewed as an evolutionary integration of organization, technology and market by iterating series of activities: search, select, implement and capture.

2.10 Conceptual model
From the above literature review, we can summarize the overall variables into two groups. The first group is the dependent variable and independent variable, as posited in Table 1. The second group is the intervening variable and the moderating variable, as posited in Table 2.

<table>
<thead>
<tr>
<th>Variable types</th>
<th>Variable name’s</th>
<th>Measurements</th>
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| Dependent      | Sustainable economic development | -Economic growth  
|                |                  | -Economic stability  
|                |                  | -Economic equity  
|                |                  | - Competitive within cooperatives  |
| Independent    | Scientific/technological Innovation and policy reform | -Scientific science innovation  
|                |                  | -Reducing global warming  
|                |                  | -Disaster diminishing  |
|                | Political Science Innovation and policy reform | -United Nations policy  
|                |                  | -National government policy  
|                |                  | -Politician good governance  |
|                | Economics Science Innovation and policy reform | -Economics science innovation  
|                |                  | -Not maximizing but optimizing  
|                |                  | -Income distribution  |
|                | Business Science Innovation and policy reform | -Business science innovation  
|                |                  | -Not encourage consumption  
|                |                  | -Corporate governance  |
|                | Legal Science Innovation and policy reform | -Legal science innovation  
|                |                  | -Legal transparency and accountability  
|                |                  | -Regional governance network  |
|                | Educational Science Innovation and policy reform | -Educational science innovation  
|                |                  | -Curriculum reform  
|                |                  | -School and society  |

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<tr>
<th>Variable types</th>
<th>Variable name’s</th>
<th>Measurements</th>
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| Intervening    | Global purifier | -Over population growth  
|                |                  | -Over consumption & financial problem  
|                |                  | -Over use of resources  
|                |                  | -Over use of energy  
|                |                  | -Natural disaster  
|                |                  | -Food security and energy crop  
|                |                  | -Environmental decay  |
| Moderating     | Competitive within cooperatives | -Knowledge management network  
|                |                  | -Information management network  
|                |                  | -Technology management network  
|                |                  | -Innovation management network  |
Figure 1: Interdisciplinary Policies Reform on Scientific Innovation, Technological Innovation, and Economics Innovation for Sustainable Economic Development

- Economic growth
- Economic stability
- Economic equity
- Competitive/cooperative

Source: Petchprapunkul C. (2012)  
Paper presented at the International Congress on Innovation and Regional Economic Development 2012 at the USTC China  
2-4 December 2012
3 Research Methodology/model

In this study we employed the Analysis of Moment Structural (AMOS) model approach to elaborate the relationship of the variables as posited in Figure 1 of this study.

3.1 Structural model
The research model of this study is under the Analysis of Moment Structure (AMOS) program model. There is one structural model and ten measurement models. The structural model is consisted of 10 observe variables. There are six observe independent variables, one observe intervening variable and two observe of moderating variables explaining the observe dependent variable.

3.2 Measurement model
Within each unobserved latent variable there are some measurement variables. The dependent observe variable has it own four measurements of unobserved variables. Each independent variable consists of three unobserved measurements. Between dependent and independent variable there are also the seven unobserved intervening variables and other four unobserved moderating variables influencing on the relationship between the dependent and independent variables.

The respondents will be asked to answer the questionnaire and the answers will put into the AMOS program to calculate the covariance, correlation, multiple correlation, regression weight, the adjusted regression weight, to identify the model fit of the research. The questionnaire as posited in appendix 1.

Appendix
Questionnaires

The attitude of people on the global warming, natural disaster, financial problem, and economic downturn on the Sustainable Economic Development (SED)

Instruction: This questionnaire is designed to evaluate the attitude of the respondent on the issue of sustainable economic development by using the Likert-type scale (1932). The rating scale starting from 15 to 1 which 15-13 = strongly agree, 12-10 = moderately agree, 9-7 slightly agree, 6-4 disagree, 3-1 strongly disagree. You can rate them within the range from 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, to 15.

<table>
<thead>
<tr>
<th>Types</th>
<th>Variables / Factors /Measures</th>
<th>15-13</th>
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<td>Not maximizing but optimizing is the most important issue for SED</td>
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<td>Corporate governance is the most important issue for SED</td>
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<td>Curriculum reform is the most important issue for SED</td>
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<td>School and society is the most important issue for SED</td>
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<td>Interv1</td>
<td>Over population growth is the intervening to SED</td>
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<td>Over consumption &amp;financial problem is the intervening to SED</td>
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<td>Over use of resources is the intervening to SED</td>
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<td>Interv4</td>
<td>Over use of energy is the intervening to SED</td>
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4 Analysis and conclusion

Finally, this study proposed that, to encourage people in our society to reduce the global warming problem, to reduce the natural disaster from the over consumption of human being. To avoid and reduce the financial problem and the economic downturn, we have to promote the concept of “The Interdisciplinary policy reform on scientific innovation, technological innovation, and economic innovation for sustainable economic development. The following 33 questions in the questionnaire are needed to be kept in mind of our world population and can be tested comparatively from country to country.

References