Sensitivity Analysis of Government Policies Implementation on Mobility of Indonesian Students Abroad

Inayati, Tutik
Arai, Takeshi
Department of Industrial Administration, Faculty of Science and Technology Tokyo University of Science 2641 Yamazaki, Noda-shi, Chiba-ken 278-8510 Tel : 04-7124-1501
tutik.inayati@sbm-itb.ac.id, tarai@rs.noda.tus.ac.jp

ABSTRACT Increasing number of students pursuing education abroad has caused the decreasing number of intellectual workers in Indonesia due to remaining graduates abroad, and in effect slows down the economic development in Indonesia. The government needs to improve its policies in order to attract graduates abroad to return to Indonesia and hence increase the development of Indonesia in general. This paper's purposes are to model the mechanism of mobility of students and to run simulation of policy scenarios to determine the effects on Indonesia's condition in the future. After running base scenario simulation, four scenarios (increase in scholarship, incentives for returning graduates, incentives for patents produced in Indonesia, and increase in funding for Indonesia universities) are conducted to determine the long term projection. The results from four scenarios have different significant changes on areas depending on which intention of stocks that the government would like to change in the future. This model can be utilized in the future by Indonesia government and because this model is flexible, the government can change the parameters according to viewpoint and interest.

INTRODUCTION

Mobilization of students pursuing education abroad these days is inevitable due to the globalization era and the development of information and communication technology. Number of students abroad increases each year and the polarity of destination countries for students starts to emerge where countries as the destinations are developed countries. There are many reasons for students to go abroad; however, there are external and internal factors. Generally, internal factors are personal factors on the condition of a country; as external factors are the condition of the environment that the country provides or we can refer them as the results of government policies that directly affect their life.

On the other side, the valuable knowledge of high ranked students has become the demand of developed countries in order to develop into more competitive countries. Countries will try to recruit most valuable graduates; therefore several developed countries apply policies that may cause students to remain abroad instead of returning home after finishing their studies. In basic theory, this can be beneficial or harmful for the source country.

One of the conditions that can be harmful for the source country is when students do not return after they finish their studies; instead, they remain abroad. The transfer of knowledge is necessary for the source country in order to develop more, whether economic development in general or technology development in particular; and it begins at the phase of tertiary education pursuit. Without the returning students, transfer of knowledge is difficult; hence the development of a country is lagged. Although the information and communication technology has developed rapidly for the last 15 years, we need to realize whether the returning of students contribute to the intelligence level and economic development of the source country. Therefore, if it is essential, then it is important to analyze which policies implemented by source country government that can arouse the number of returning students; not only the amount, but also how to increase intelligence level in the source country.

This paper has two major objectives. First, is to determine the mechanism of students abroad from the beginning of the studies until their decision after they graduate, and how the mechanism of this process affect economic development and intelligence level of the source country. The second objective is to conduct sensitivity analysis implemented by the source country's government in order to find the most optimal policies in order to increase intelligence level and economic development. However, there are limitations for this study. Since this study is conducted on Indonesian students abroad as the subject of research, the mechanism and simulation of the model is based on the case of Indonesia. However, it is expected that this model can be utilized as the general model that can be applied and improved in other countries as well. Second, this paper does not consider the multiple movements of graduates; for instance, if graduates remain in the destination countries and then move to another country besides Indonesia, then the model will not show this process. These limitations can be improved as further research improvements. The novelty of this study is that this model is able to analyze and predict the effects of policy alternatives possibly implemented by Indonesian government. Another novelty of this paper is that as far as the authors had searched, there has not been a research on the mobilization of students abroad, which means the research of mobilization of potential high-skilled workers has not been conducted and modeled using system dynamics. However, methodologically there is a similar study by Chávez et al (2011) who carried on a research about migration using system dynamics but the scope of their research involved people of Michoacán regardless of their education background, and the main focus of their research is the remittance sent to their hometown can contribute to the development of the city in general.
This paper consists of several parts: (1) Introduction, which consists of background, objectives, and limitation of the research; (2) literature review, which consists of related research to the topic; (3) model building and factors influencing decisions, which consists of causal loop diagram and result of questionnaires; and (4) sensitivity analysis, which consists of simulation result, policy scenario simulation, and recommendation for the government.

RELATED RESEARCH

Education and mobility

Barro (1991) mentioned that level of schooling across countries is able to explain the gaps of development in countries. Studying abroad is a common event in this era. While most students choose universities abroad for its education quality, some choose education abroad because of personal reasons. Either way, the trend of pursuing higher education abroad has increased and several countries famous for their education quality become destinations for Indonesian students to pursue their education.
Wie (2006) mentioned about the performance of public research institutes has not been satisfactory, the facilities for research provided by the government is also not very adequate to promote technology development in Indonesia. Also laboratories are understaffed and underfunded. This means the condition for research and development in Indonesia cannot compete with Indonesia's neighbour countries, such as South East Asia country. Hence, students who major in specialized area whose demands cannot be met in Indonesia will choose to work abroad since the research facilities provided by the government is not adequate to support their work.

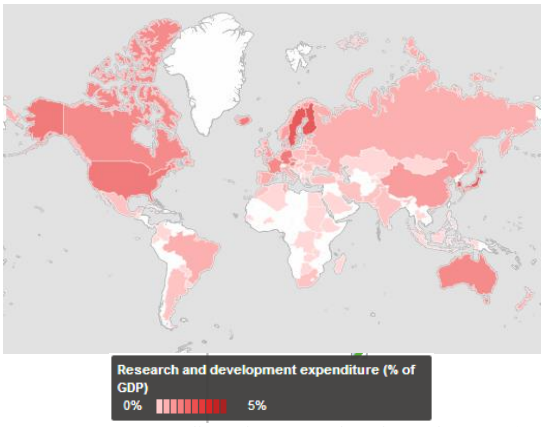


Figure 1. Government's expenditure for Research and Development (2008-2012)
Source: World Bank, 2008-2012

Meanwhile, all those factors above are not enough to promote students to work abroad after they graduate; students also consider the working climate that is influenced by the national culture or relevant regulations. When the working climate matches the characteristics and the way of thinking of graduates, they will try to stay in that country**.** (Forstenlechner, 2010)

Other important findings on Turkish international students are explored by Tansel and Gungor (2002). Respondents mentioned that in choosing current institution of studying abroad, they consider is that the institutions that they are in provide the most suitable programme for their field of specialisation, while others are the respondent's ability to obtain acceptance, better financial support or scholarship opportunities offered by the university, recommendation of the adviser or other professors, and the possibility of greater job opportunities.

Findings by Tremblay (2004), there are many effects of student mobility for the host countries, such as: (1) the increase of national funding for education by the contribution of financial source of foreign students; (2) the economic contribution by foreign students, such as lodgement and living purchases, while they stay in the host countries; and (3) the knowledge and skill contributions by foreign students adding the development of host countries. Also, Tremblay mentioned effects of student mobility for the host countries, such as: (1) the increase of national funding for education by the contribution of financial source of foreign students; (2) the economic contribution by foreign students, such as lodgement and living purchases, while they stay in the host countries; and (3) the knowledge and skill contributions by foreign students adding the development of host countries.

Government policies related to migration

Government, whether Indonesia or destination countries, has big impact on the decision of students to remain abroad or return home after graduation. Therefore, government policies have indirect impact on the mobility, they influence the environment that students prefer to live in and work in. So far, from Indonesia government side, the policies are not strong enough to support graduates abroad to return home; therefore students who return home are based on the personal values, not because of professional or future work related. Meanwhile, developed countries support international students to work in their countries through their immigration policies. For example, Australia provides six months of permanent residence for international graduates to work in their countries. The similar policies are also implemented by New Zealand and Canada (Tremblay, 2004). However, developed countries should be able to cooperate with source countries so that source countries can develop more with the transfer of knowledge that students

gain abroad. The increase in tax and reduction in educational subsidies will result in low demand in education, and a reduction in other public expenditures will lower the level of human capital. (Schiff, 2005)

On the other opinion, Tansel and Gungor (2002) suggested that the scholarships provided by the government should be in shorter period; this is in sync with the theory that the length of stay influences the decision students make after graduation. Meanwhile, Thorn (2009) mentioned that the decisions of students influenced by governments are only the remuneration and escalating economic situation. Therefore, this study believes that there are other policies influence decisions of students after graduation and then to suggest other alternative policies implemented by Indonesia government that will affect students' decisions aside from personal factors.

MODEL BUILDING (MOBILITY)

Causal Loop Diagram

Causal loop diagram is the beginning stage of the model building, and later we will discuss about stock and flow diagram. Below is the diagram of causal loop. There are several main variables to build the model: government budget, economic condition, new entered students, studying in Indonesia, studying abroad, educational quality, decision factors, financial support, working abroad, working in Indonesia, intelligent level, quality of life abroad, job opportunity abroad, and capacity and support abroad. In the simulation, we focus on the result of intelligent level, economic condition, studying abroad, working in Indonesia, and working abroad. Also, this paper will run the simulation of policy scenarios to identify the effects of those variables if the policies are implemented in the future.

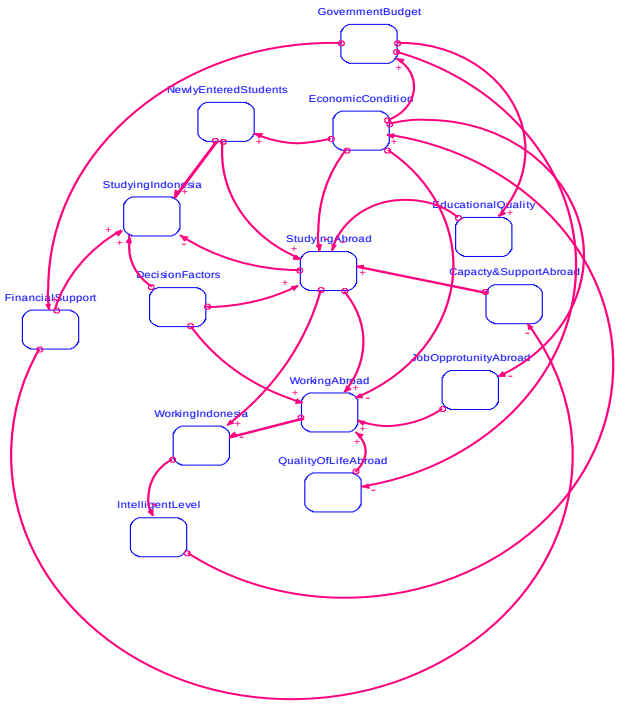


Figure 2. Causal Loop diagram of student mobility

In this causal loop, studying abroad is influenced by many factors such as economic condition, education quality, capacity and support abroad, studying in Indonesia, number of new students, and personal decision factors. Working abroad is also influenced by several factors, such as job

opportunity, quality of life, personal decision factors, and also the number of students studying abroad. When graduates work abroad, it will automatically influence the condition in Indonesia such as intelligence level and economic condition; and in the end it will influence the number of students abroad. Decision factors included in this model will be explained in the descriptions below.

Variables influencing decision factors

In the model, there is one variable called decision factors, these factors were determined using questionnaires spread to respondents abroad. In the questionnaire, there were 20 variables asked to the respondents on the importance level (from scale 1 to 5) of those variables. However, we decided would like to consider only the five variables considered the most important.

Table 1. Ranking of importance to live or study in a country

Factors	Average
Opportunity to work in suitable fields	4.56
Surrounding's or general country's safety	4.44
Easy communication with colleagues	4.44
Equal opportunity for every religion	4.42
Opportunity to work in desirable fields	4.42
Distinct career path in workplace	4.4
Financial and health support from employer	4.38
Easy communication with family and friends	4.34
Health support from the Government	4.28
Equal opportunity for every race	4.26
R&D budget	4.26
Supportive community or neighborhood	4.24
Research field's variety	4.22
Scholarship availability	4.20
Area of specialization's variety	4.18
Equal opportunity for every gender	4.16
Political stability	4.06
Average salary	3.8
Strong culture or tradition	3.44
Foreign investment / the amount of multinational companies in a country	3.38

Finally, after cross checking with literature background, we can conclude that variables be included in the simulation are job opportunity, communication with family and friends, communication with colleagues, education quality, and financial support. Job opportunity, education quality, and financial support comparison between Indonesia and destination countries can be seen through the gap. Meanwhile, communication with family and friends and communication with colleagues are personal factors, which depend on each person’s intensity in communicating.

Decision factors will influence whether directly or indirectly to the mobility of students and graduates on deciding where to study and work. Therefore, it is important in the model to include the decision factors as internal factors aside from external factors.

Stock and Flow Diagram

Below is the stock and flow diagram students' mobility, which is simplified in order to understand the basic mechanism. The beginning of the stock and flow diagram is the pursuit of undergraduate studies where students have choices between studying in Indonesian university and university abroad. After they graduate, they have choices whether they will return or remain, or continue their studies abroad. Similar to undergraduate flow, post graduate students have choices where to work. In the end it will affect the intelligent level, economic condition, and to the beginning of undergraduate students flow.

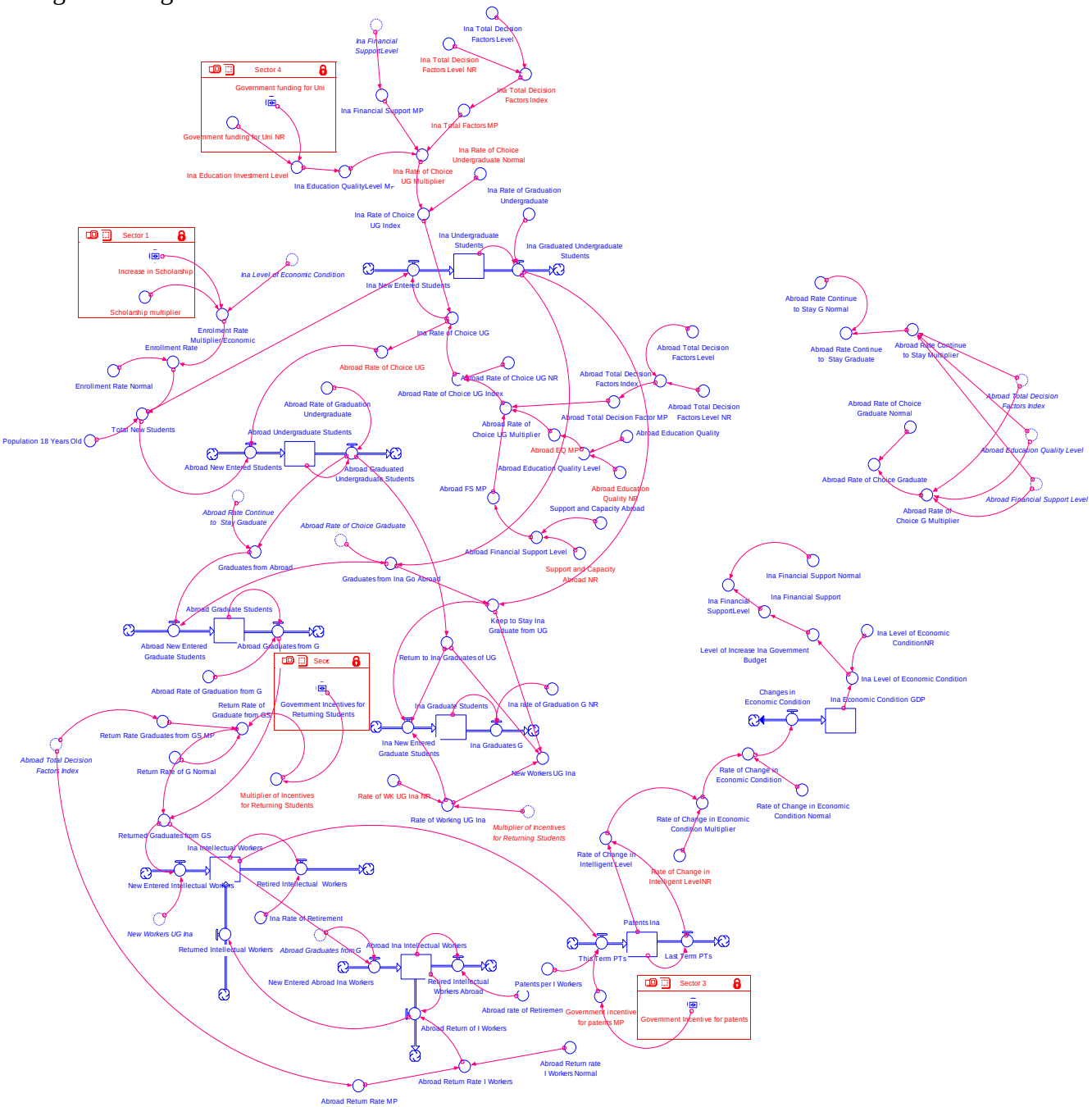


Figure 3. Stock and flow diagram for students' mobility

SIMULATION AND SENSITIVITY ANALYSIS

Basic result

As mentioned before, variables' behavior that we would like to see are the number of students, whether it is undergraduates or post graduates, and whether abroad or in Indonesia; number of patents; Indonesia's economic condition based on GDP; and intellectual workers in Indonesia and abroad.

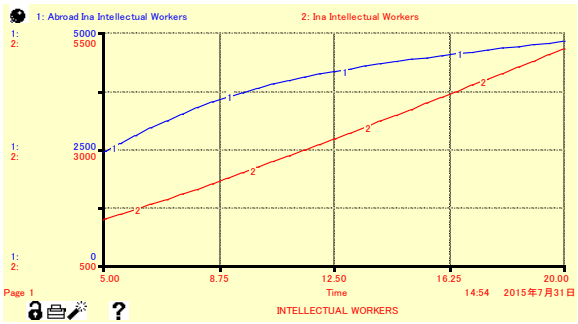


Figure 3. Base scenario (intellectual workers in Indonesia and abroad)

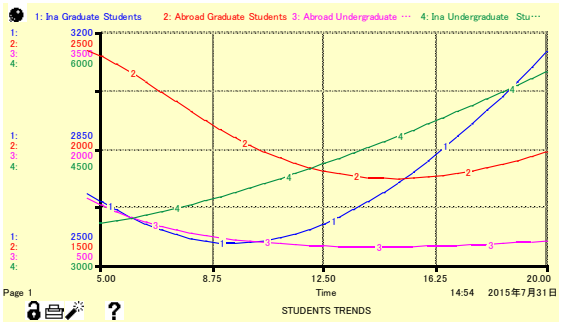


Figure 4. Base scenario (number of undergraduate students abroad and in Indonesia; and number of graduate students abroad and in Indonesia)

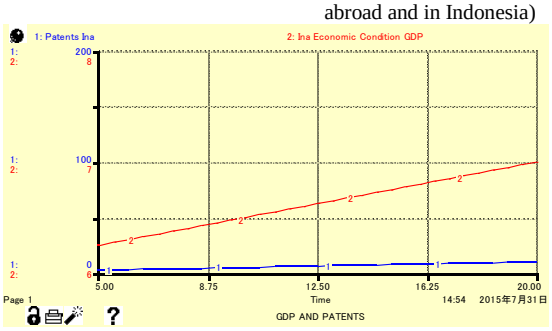


Figure 5. Base scenario (Indonesia economic condition based on GDP and number of patents in Indonesia)

As mentioned before, the time length of this study is 20 years, therefore the trend is in long term. However, since we can only see the fluctuation after year 5, hence these graphs showed the trend after year 5. In figure 3, the trend of Indonesian intellectuals abroad rise exponentially, meanwhile intellectuals in Indonesia increase almost constantly. Figure 4 shows the trend of students going to study abroad and in Indonesia, undergraduate and graduate level. As expected, with the increase of GDP the number of undergraduate students increases almost constantly, with the slow decrease and then increase for undergraduate students abroad. As for graduate students, the trend will rise sharply after slow decrease in Indonesia, as in abroad the trend also shows slow decrease and then slow increase. Figure 5 shows a very slow yet almost constant increase trends in patents produced by intellectuals in Indonesia in the future while Indonesia's economic condition based on GDP has a constant increase.

Policy scenario

We have seen the trends of base scenario. Therefore, there are several alternatives of policies that can be implemented by the government: increase in scholarship availability, government incentives for patents made by Indonesian workers in Indonesia, government incentives for returning students, and increase of funding in government universities. Sensitivity analysis will be provided in order to know the change of trends of specific variables that we would like to see. Each scenario will implement when the government is focusing only to one policy support rather

others. The graphs of policy scenarios can be seen at the end of this paper, but we try to analyze the results of each graph.

First policy scenario is when Indonesia government focuses more on scholarship to its citizens to pursue their tertiary studies whether abroad or in Indonesia (figure 6, 7, and 8). What we would like to see is the changes that the policy has made compared to base scenario. First, the shape of the trend is similar but for Indonesian intellectuals abroad the growth begins to slow down compared to the base scenario, meanwhile Intellectuals in Indonesia has higher growth. Concerning the number of university students, the trends' shapes are not different from base scenario, only slightly extreme increase on graduate students in Indonesia. As for number of patents produced in Indonesia, the trend shows promising rise compared to the base scenario although it does not affect the growth of economic condition much.

For the second scenario, Indonesia government focuses more on the incentives for every patent produced in Indonesia. The results show that there is no significant difference from first scenario. However, we can see that the trend of number of graduate students in Indonesia does not have increasing growth as extreme as first scenario. Also, the number of patents in Indonesia has better trend than first scenario. Therefore, we can conclude that this policy implementation has similar effects with if Indonesia government focuses on scholarship to its citizens.

The third scenario is when Indonesia government implies the incentives for returning graduates; the graphs show several differences compared to base scenario and previous scenarios explained. First, the number of intellectuals in Indonesia increase but not as significant as previous scenarios and the base scenario. It is considered surprising since the objective of this policy implementation to increase the number of intellectual people in Indonesia. However, the number of Indonesian intellectuals abroad has exponentially increasing trend but not as big as previous scenarios. Second, the different trend in this policy implication is the trend of the number of graduate students in Indonesia; the trend is declining but it stabilizes just above the undergraduate student abroad level. However, the surprising different is in the number of patents produced; in long term projection, the number of patents is higher than all scenarios. Therefore, if the government has objectives to increase the number of patents, it should focus on the incentives for returning students.

The last scenario is when the focus is on increasing funding for universities in terms of laboratory facilities, improvement of lecturers wellbeing, and others that can induce the quality of universities in Indonesia. This policy implementation can attracts the number of graduate students in Indonesia; this pattern is similar to the first scenario where the government implies increase in scholarships. Other patterns are also similar to the first scenario; hence we can make conclusion that whether to apply first policy or fourth policy, the situation will be quite similar in the long term because basically they promote education access to citizens and strengthen the quality of universities in Indonesia.

In the end what can be established from the policy scenarios discussed above is that Indonesia government can predict, in the long term, the effects on their policies in different area that they want to concentrate in, for instance, the number of students in Indonesia and abroad. Second, and the most important thing is since this model is an initial model and no predecessor model about mobilization in Indonesia, it can be used as a ground model and presented to Indonesia government to get more accurate numbers in the parameters.

REFERENCE

1. Bank, W., 2008-2012. *World Bank Data.* [Online] Available at: http://data.worldbank.org/
2. Barro, R., 1991. Economic Growth in a Cross Section of Countries. *Q. J. Economics,* Volume 106, pp. 407-444.
3. Chávez, J. C., Rodríguez, J. C., & Wilkie, J. W. (2011). A System Dynamics Model of Employment and Migration for Mochoacán. PROFMEX Journal Mexico and the World, 1-12.
4. Forstenlechner, I., 2010. Exploring Expatriates' Behavioral Reaction to Institutional Injustice on Host Country Level. *Personnel Review,* 39(2), pp. 178-194.
5. Schiff, M., 2005. Brain Gain: Claims about its Size and Impact on Welfare and Growth Are Really Exaggerated, s.l.: The World Bank.
6. Tansel, A. & Gungor, N. D., 2002. "Brain Drain" from Turkey: Survey Evidence of Student Non-Return. *Career Development International,* 8(2), pp. 52-69. [Accessed 19 November 2013].
7. Thorn, K., 2009. The Relative Importance of Motives for International Self-Initiated Mobility. *Career Development International,* 14(5), pp. 441-464.
8. Tremblay, K., 2004. *Links Between Academic Mobility and Immigration.* [Online] Available at: http://www.wes.org/
9. Wie, T.K. 2006. Policies Affecting Indonesia's Industrial Technology Development. *ASEAN Economic Bulletin,* 23(3), pp. 341-359.

Table 2. Scenario 1 Simulation Result

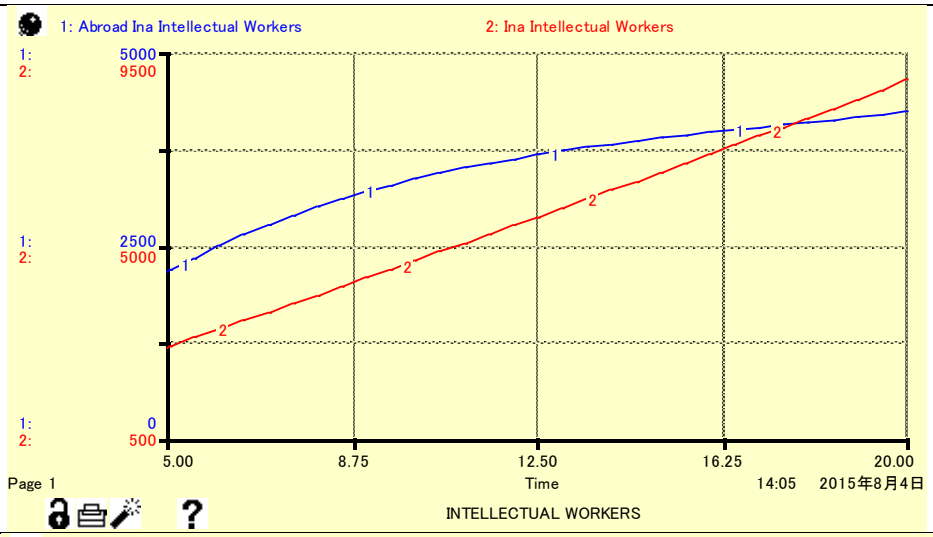
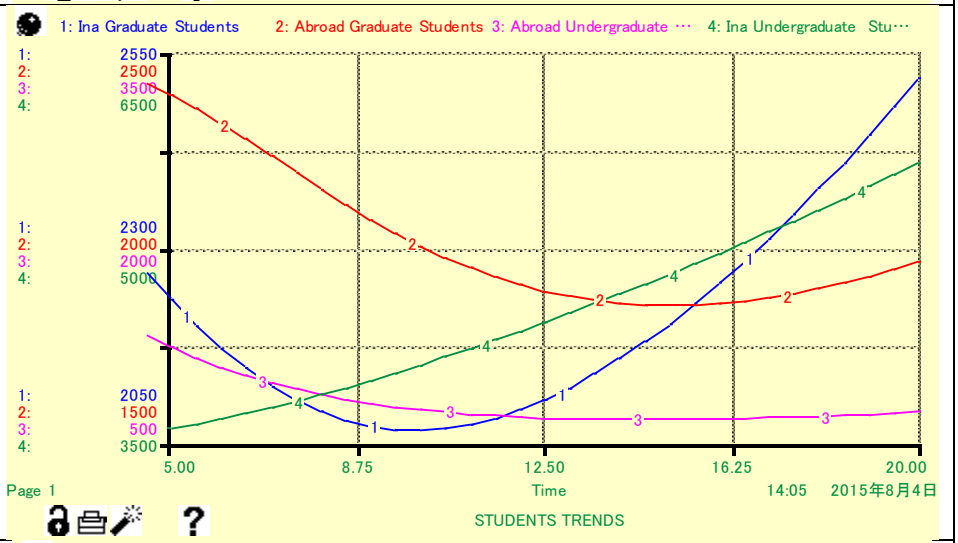
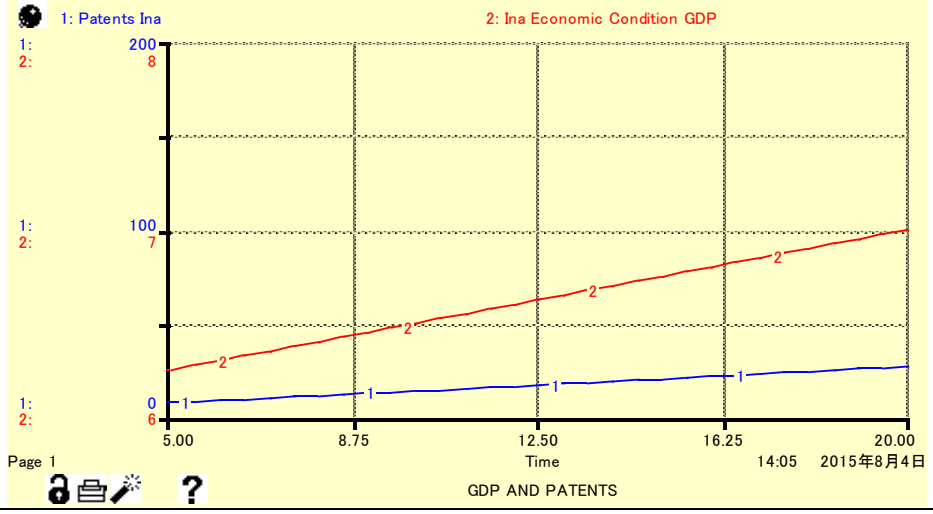
Figure 6. Scenario 1(intellectual workers in Indonesia and abroad)	
Figure 7. Scenario 1 (number of undergraduate students abroad and in Indonesia; and number of graduates abroad and in Indonesia)	
Figure 8. Scenario 1 (Indonesia economic condition based on GDP and number of patents in Indonesia)	

Table 3. Scenario 2 Simulation Result

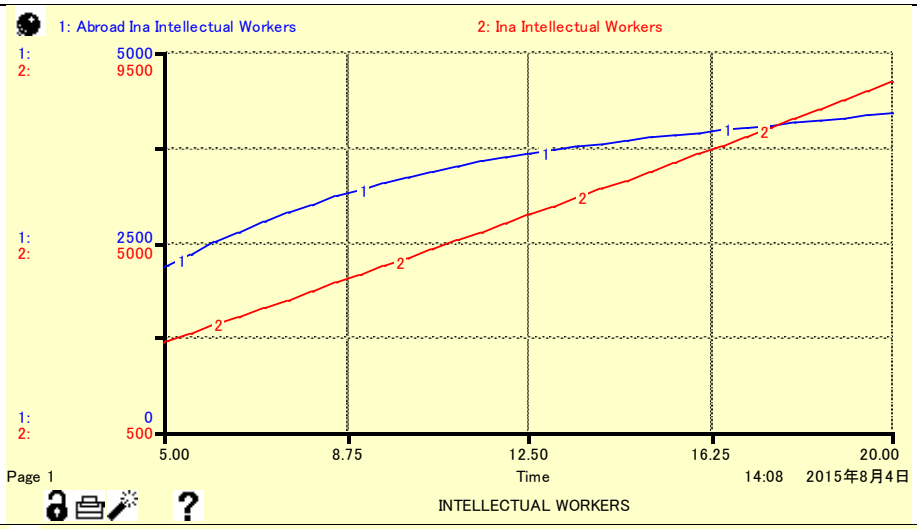
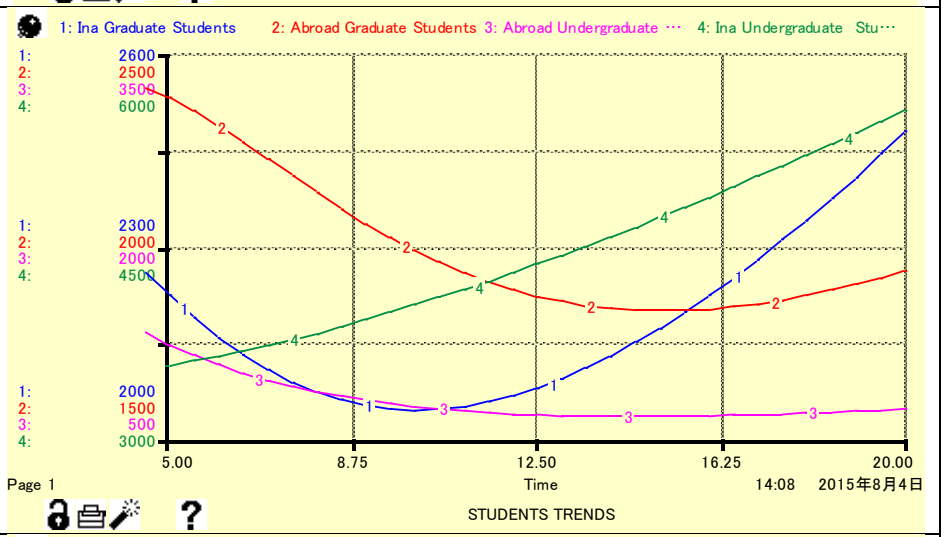
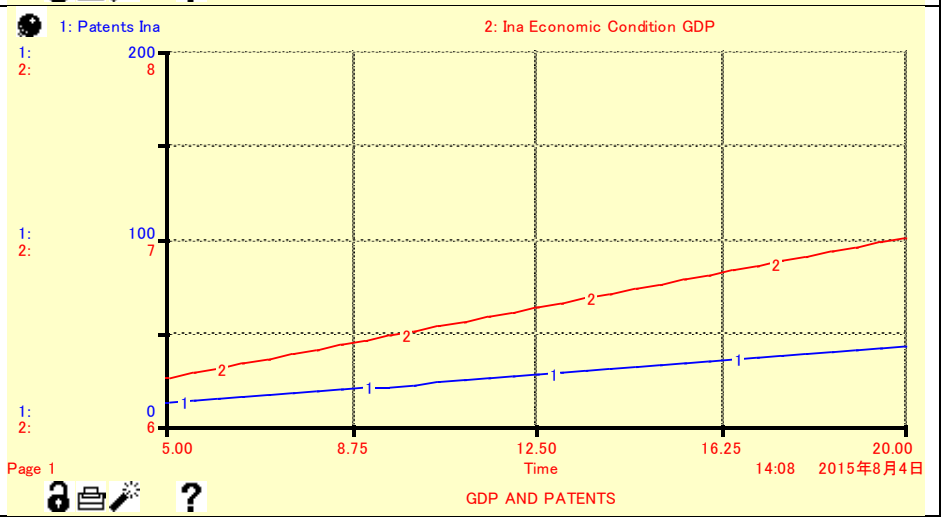
Figure 9. Scenario 2(intellectual workers in Indonesia and abroad)	
Figure 10. Scenario 2 (number of undergraduate students abroad and in Indonesia; and number of graduates abroad and in Indonesia)	
Figure 11. Scenario 2 (Indonesia economic condition based on GDP and number of patents in Indonesia)	

Table 4. Scenario 3 Simulation Result

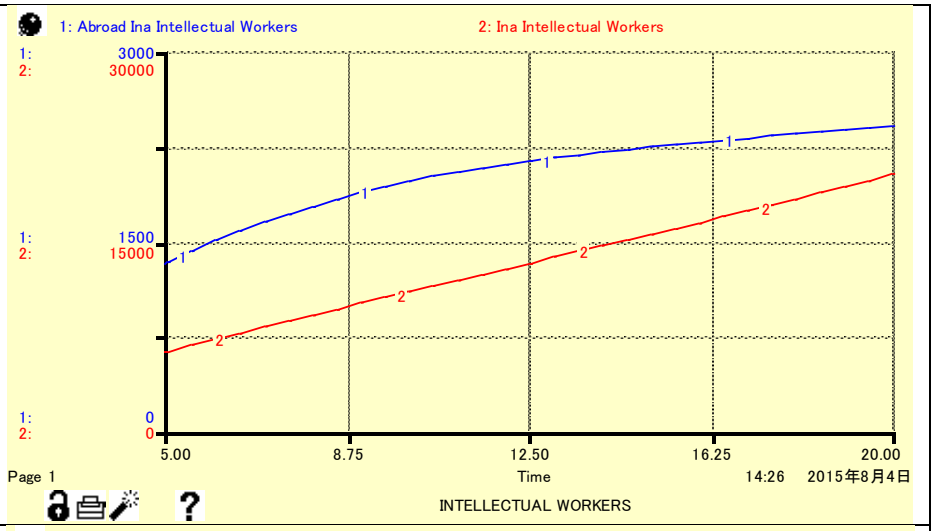
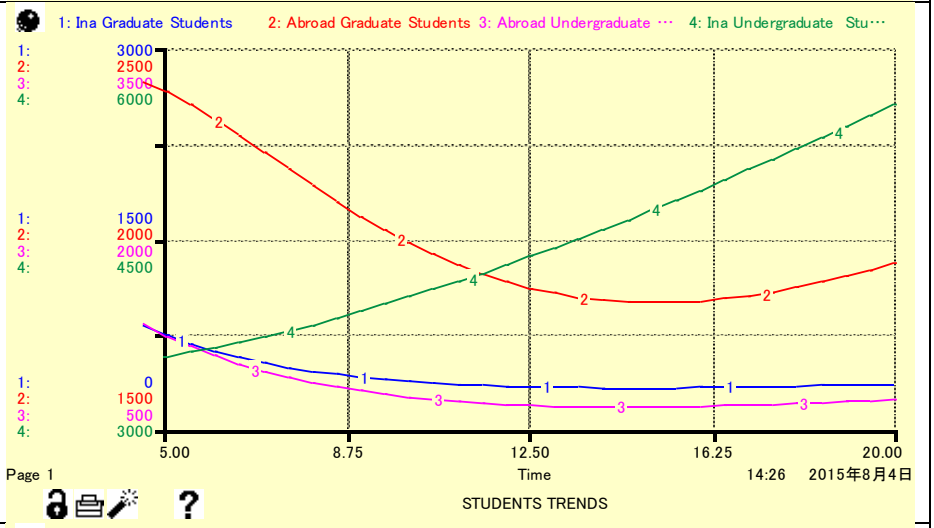
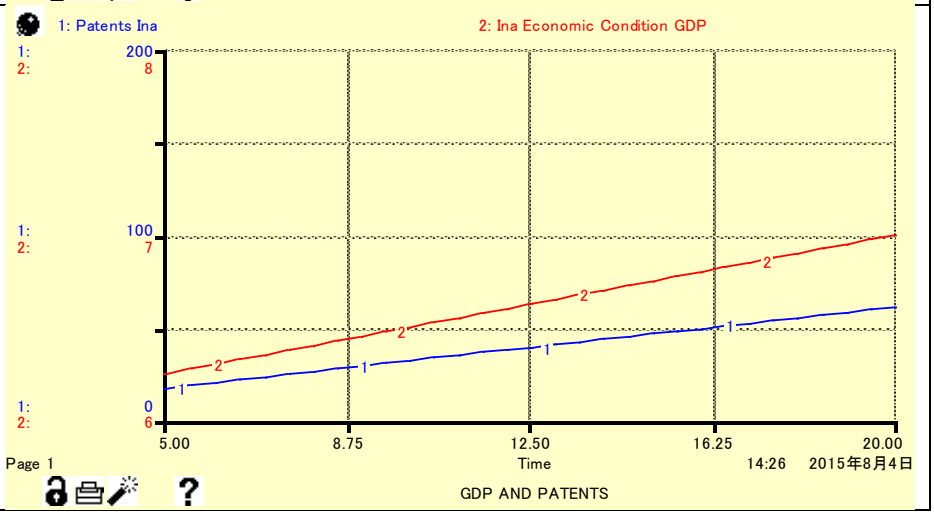
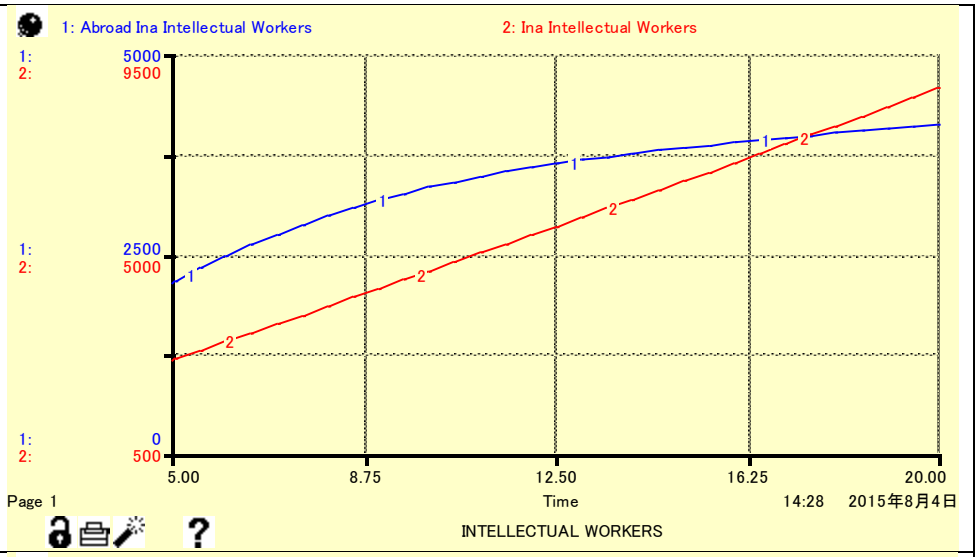
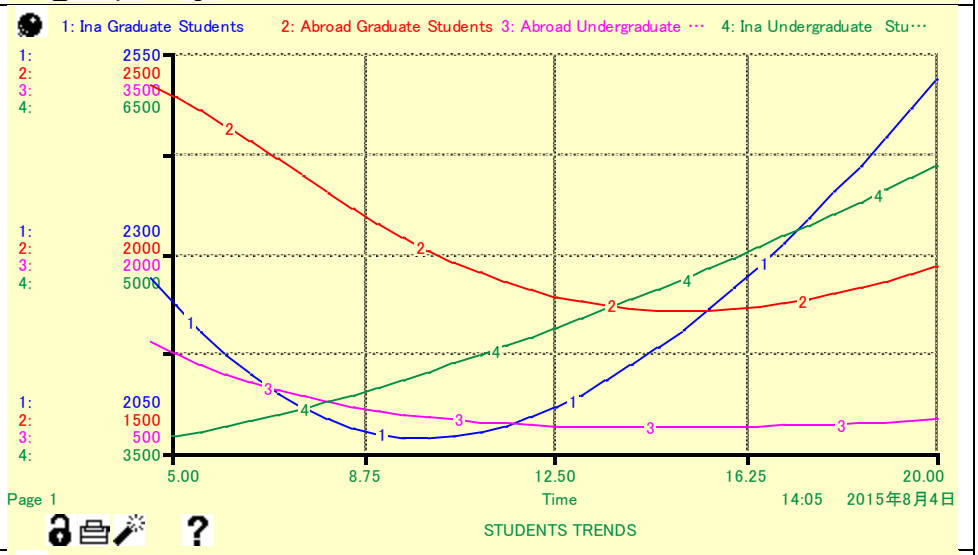
Figure 12. Scenario 3(intellectual workers in Indonesia and abroad)	
Figure 13. Scenario 3 (number of undergraduate students abroad and in Indonesia; and number of graduates abroad and in Indonesia)	
Figure 14. Scenario 3 (Indonesia economic condition based on GDP and number of patents in Indonesia)	

Table 5. Scenario 4 Simulation Result

Figure 15. Scenario 4(intellectual workers in Indonesia and abroad)	
Figure 16. Scenario 4 (number of undergraduate students abroad and in Indonesia; and number of graduates abroad and in Indonesia)	
Figure 17. Scenario 4 (Indonesia economic condition based on GDP and number of patents in Indonesia)