

Linking Supply on Demand of Indonesia Human Resource in Science and Technology on Perspective Black Swan Phenomenon

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Abstract

This paper discusses how the influence of the phenomenon of black swan in the development of human resource on science and technology (HRST) in Indonesia. Indonesia was predicted to become a developed country in 2025 with GDP growth conditions in 2025 reached 9%. While the government is implementing policy that is linking the labor supply on demand through Indonesia National Qualification Frameworks (KKNI). Both of these issues become background of black swan phenomenon. Indonesia HRST model has main structure that is sub model supply and demand. Simulation models use to absorb the phenomenon black swan through targeted GDP growth scenarios as well as link and match that assumes that the average waiting time to get a job of HRST is 3 months. HRST model are particularly vulnerable to KKNI policy. It means to be a developed country, Indonesia should prioritize a policy in qualifying HRST supply on labor market, taking into account the effectiveness of link and match program which has been running at the moment.

Keywords: Indonesian HRST, KKNI, supply demand, the black swan, developed country

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Introduction

Indonesia is a developing country which has a population of about 255 million people. With the number of the population, Indonesia is the fourth most populous country in the world. Indonesia's population growth rate between 2000 and 2010 was around 1.49 per cent per year. During this period, Indonesia has increased the population of childbearing age or who is often called demographic dividend, with dependency ratio below 0.5. Indonesia's workforce in 2013 is 121 million with a labor force of 114 million people. With a human development index continued to increase to 68.90 in 2014, the demographic bonus provides an opportunity for Indonesia to take advantage of the productivity of the population in the labor force so that it can be a potential in increase the nation's economy.

While in Indonesia's development plans in 2025 had stated that the knowledge-based economy driven by human resources that is able to utilize and produce technology for development, so that the required acceleration and national science and technology human resource capacity. Knowledge-based economic development is based on two important issues, the national innovation system and the quantity, quality and mobility of human resources of science and technology (HRST). Development of knowledge-based economy is known as a driver of productivity and economic growth [OECD, *The Knowledge-Based Economy*, Paris, 1996 p.7]. So as to meet the 2025 development plan, Indonesia needs to know the development of science and technology human resources Indonesia until 2025.

Research on the Human Resources Science and Technology (HRST) in Indonesia has been done in 2015. The study is "Indonesia Scenarios of HRST 2025" aims to formulate models of supply and demand Indonesia HRST and prediction of Indonesia HRST up to 2025. The results showed that the proportion of HRST Indonesia against a workforce of around 6.2% in 2014, with growth of supply is greater than demand. This means that HRST supply of college graduates are not working in the field of science and technology, and higher education academic qualification does not correspond to the needs of the labor market. In 2013 only amounted to 16.5% demand can be met by supply. So the analysis while it can be said that the link and match between supply and demand on HRST not occur optimally.

While today, the base sectors of Indonesian economic activity has shifted from the agricultural sector into the country with the growth of the manufacturing industry and services is greater. The economic upturn has also brought increased prosperity, which is reflected not only in increasing per capita income, but also in the improvement of various other social and economic indicators including the Human Development Index (HDI). In the period 1980 and 2010, the Human Development Index increased from 0.39 to 0.60. Economic growth which is characterized by an average GDP growth from 2001 to 2014 amounted to 5.4%, and Indonesia managed to get through the economic crisis in 2008 through micro or small and medium businesses. So that Indonesia is able to rank the 17 largest economies in the world.

Master plan for the Acceleration of Development Planning of Indonesia (MP3EI) predicted that Indonesia could become a developed country in Indonesia will become a developed country by 2025 with a per capita income ranging between USD 14,250 -

USD 15,500 with a total value of the economy (GDP) ranged between USD 4.0 - 4.5 trillion (KP3EI, 2011). City Research also predicts that Indonesia will be included into the Top 10 World Economy or country with the strongest economy in the world by 2025. Indonesia will be aligned with the position of developed countries such as India, China, Korea and Germany. This is evident from the emergence of newly industrialized countries, such as South Korea, Thailand, Malaysia, Taiwan, and China is showing progress in the field of science and technology very closely with the country's economic growth. Science and technology-based economic development can be realized if the government is able to settle the infrastructure, optimize government spending and improve the quality of human resources.

Predictions of Indonesia will become a developed country by 2025 is a black swan phenomenon that will be shown in this paper. Due to the fact that the Indonesian government is no longer referring to the MP3EI. But if only predictions it will happen what should be prepared by Indonesia government primarily associated with the development of HRST in Indonesia as a driver of the nation's economy. Therefore, this paper will absorb the phenomenon of Indonesia will become a developed country in 2025 HRST in the model to see the effect on the economic growth scenario Indonesia HRST.

Analytical Framework

Human resource on devoted on science and technology is a human resources involved in science and technology activities, involved means taking a role in science and technology activities to have the education and / or working on the field of science and technology, and will Likely to be the driver of economic growth , Definition of Human Resources Science and Technology refers to Canberra Manual 1992 which is one of Frascati Family manual published by the OECD. Canberra manually categorize HRST in two categories: HRST based Occupation (HRSTO) and HRST based Education (HRSTE). Two of these categories show a different dimension, the dimension that is HRSTE supply side and demand side dimension is HRSTO. So that definitive HRST is "Successfully completed education at the third level in a S & T field of study" (classification of science and technology fields of study refers to the International Standard Classification of Education (ISCED)). "Not Formally qualified as above, but employed in an S & T occupation where the above qualifications are normally required" (job classification in the field of science and technology refers to International Standard Classification of Occupation (ISCO)).

HRST formulation approach to human resource model using supply and demand forecasting. This approach provides two perspectives on the data that is HRST Analysis Demand and Supply Analysis. Demand analysis identifies current conditions in Indonesia and in the past. Economic conditions, public welfare, quality of education, and so forth. The next process is the assessment of the condition relating to the effect on the growth of HRST in Indonesia in the present and the past.

Based on the results involving the historical data, the next process is the prediction of HRST request basis of educational qualifications and employment in 2025. Supply analysis is divided into two general categories: internal and external supply. Internal supply identifies changes that occur to the HRST Indonesia. Changes that occur both

in quantity and activity. Both of these are affected by the policies imposed by the government and the college at the time, as the main producer of HRST Indonesia (internal). Factors that affect the HRST from the "Internal Supply": (i) the existence and movement of HRST (human resources flow), (ii) supply current science and technology human resources (human resources Stock). (iii) the level of science and technology human resource productivity or performance. In addition to internal inventory, also conducted an analysis of the external supply. This process is the process of predicting stock HRST from abroad, such as foreign nationals who have qualified as science and technology human resources. The end of the process is to reconcile the needs and demands of HRST in Indonesia until 2025. HRST scenario that may be produced is surplus, deficit or balance between demand and supply of human resources Science Indonesia up to 2025.

HRST data require the employment data by obtained from national labor force survey (SAKERNAS) that implemented by national statics unit (BPS). According to BPS workforce is resident whose activity in the reference period (one week) are working and looking for work. While the labor force is not a resident of the activity in the reference period (one week) is a school, find a job and more. Idle period is the period during which someone continuously unemployed or unemployed duration of the average worker. Older unemployed depends on (i) organization of the labor market, with regard to the presence or absence of institutions or labor suppliers and so on, (ii) Geographical situation of the labor force, as discussed above (iii) the ability of the desire of the unemployed to remain looking for a better job (iv) the availability and shape of companies (Dharmakusuma, 1998). Figure 1 shows trend of Indonesia HRST stock from 2000 until 2014.

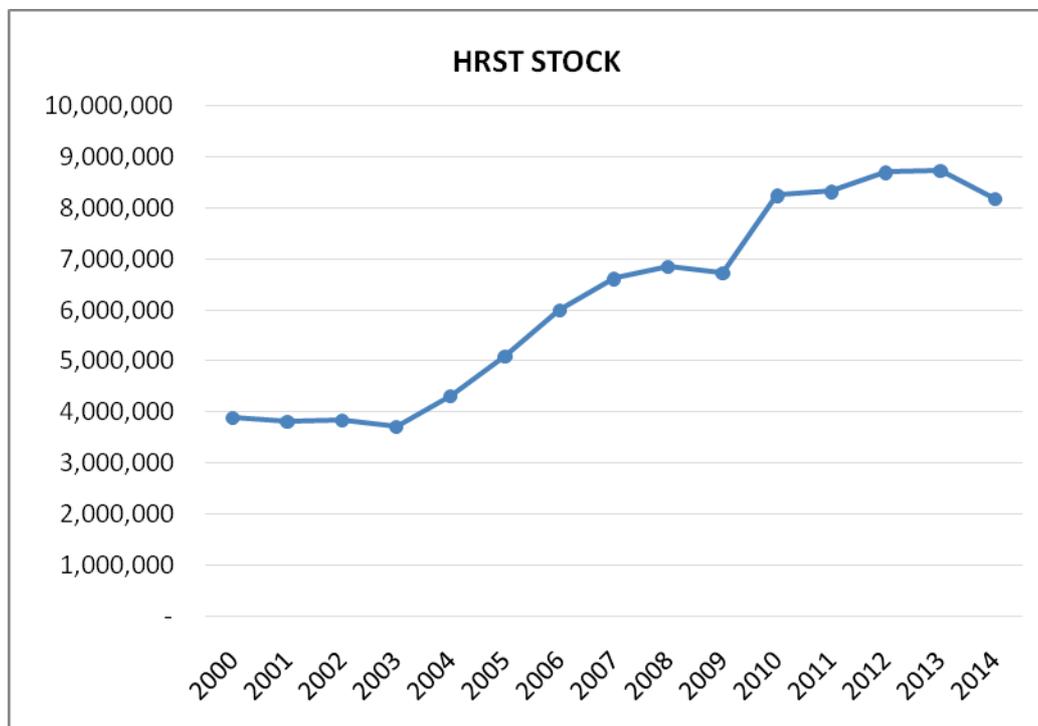


Figure 1: Indonesia HRST Stock from 2000-2014

While HRST supply data is obtained from Ministry of research technology and higher education. HRST data supply is the data of graduates from universities in the field of science and technology. Figure 2 shows the trend of Indonesia HRST supply from 2002 until 2013.

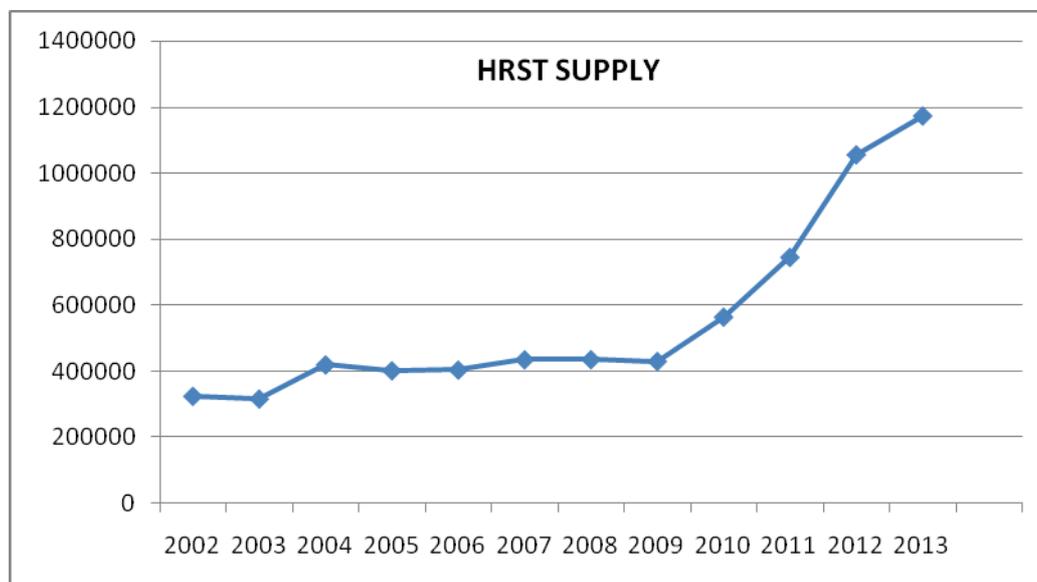


Figure 2: Indonesia HRST supply, 2002-2013

Black Swan on Indonesia HRST Model

HRST model consists of a sub-model of economy, technology, HRST demand, expected HRST, HRST, HRST education capacity, HRST supply and Wage. Seventh sub models are interrelated in the perspective of supply and demand. Dimensions demand is driven by affecting the targeted GDP growth elasticity technology, where technology growth follows economic growth in conditions of certain elasticity. Elasticity these technologies affect HRST technology requiring certain levels as well. Demand for HRST will create the desired HRST, which will influence the stock or the quantity of current as well as HRST supply. HRST supply is affected by the capacity of the education provided and the interest of potential HRST driven by wages. In general Indonesia HRST model is described in the following big picture. Furthermore, this model will absorb black swan phenomenon that can be analyzed to influence the future Indonesia HRST.

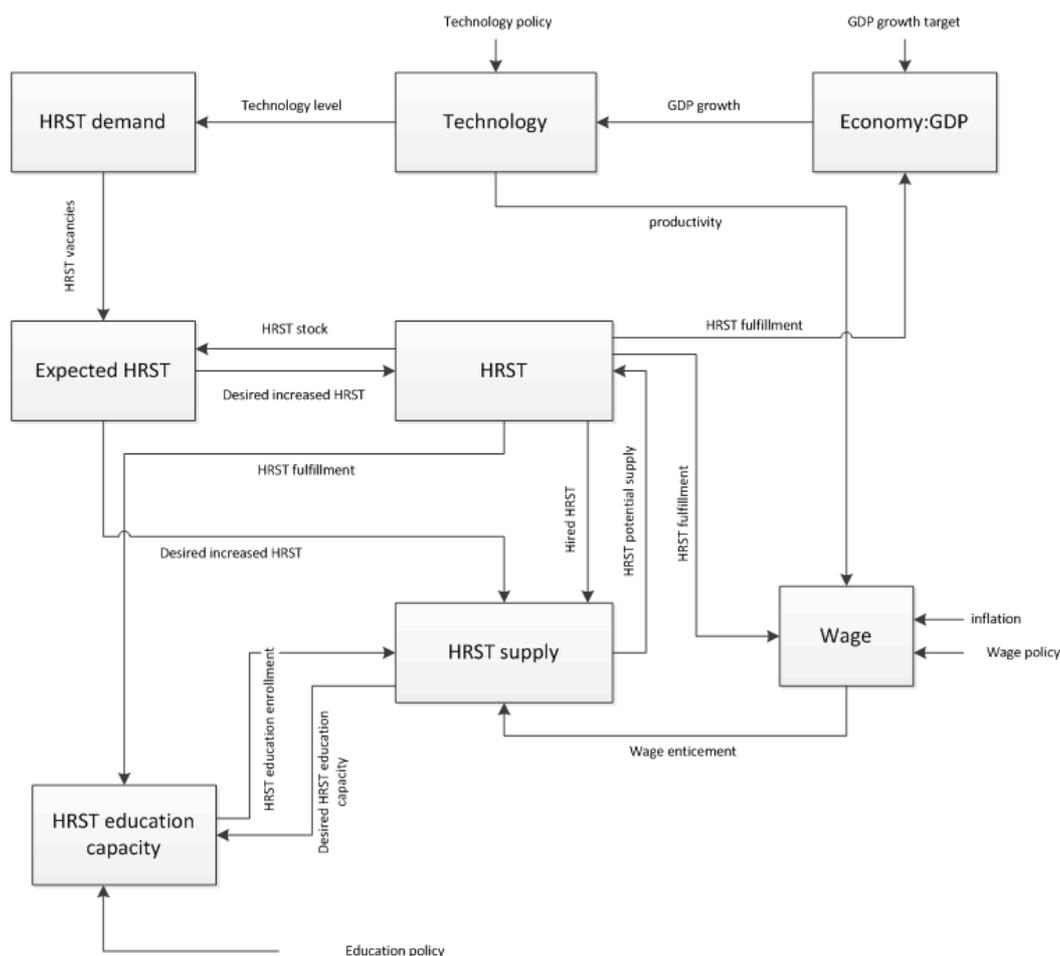


Figure 3: Big picture of Indonesia HRST model (Indri, 2015)

"A Black Swan is a highly improbable event with three principal characteristics: it is unpredictable; it carries a massive impact; and, after the fact, we concoct an explanation that makes it appear less random, and more predictable, than it was." (N. N. Taleb, 2007). Often black swan phenomenon is seen as a negative phenomenon but it just means a highly unlikely but nevertheless possible occurrence of an event (Gobler, 2010). But do not rule out that possibility in fact create a positive phenomenon, such as the phenomenon of Indonesia into developed countries. This approach could be stretched to issues, system and analyzes that are even more uncertain. That is, to what are sometimes called black swans (Taleb 2007). Although Black Swans are by nature impossible to predict, one you see one, we can include it in your system dynamics models. This Allows you to analyze the effects of the Black Swan on the model—Therefore, the phenomenon of Indonesia become a developed country is highly unlikely, but Indonesia still have to see this as a possibility that needs to be responded so that Indonesia can anticipate things that might happen in the future. The response in the face of a black swan phenomenon makes one may be able to discover new plausible futures, and possibly turn into gray swan black swan (Erik Pruyt, 2014). Moving towards a recognized ignorance also may require more robust policy designs and robust optimization to design more robust policies (Hamarat C, 2014). Especially Indonesia HRST policy in Indonesia is what to prioritize in achieving better conditions in the face of the phenomenon of black swan.

Black swan phenomenon in this paper is Indonesia into developed countries. Issue or predictive Indonesia become a developed country sparked by step the Master Plan for the Acceleration and Expansion of Indonesian Economic Development (MP3EI). Aligned with the national development vision as stated in Law No. 17 of 2007 About the National Long Term Development Plan 2005-2025, the vision for the Acceleration and Expansion of Indonesian Economic Development is "Creating an Independent Indonesian Society, Forward, Just and Prosperous". MP3EI put Indonesia as a developed country by 2025 with per capita income ranging between USD 14,250 - USD 15,500 with a total value of the economy (GDP) ranged between USD 4.0 - 4.5 trillion. To realize the necessary real economic growth of 6.4 - 7.5 percent in the period 2011-2014, and about 8.0 - 9.0 percent in the period 2015 - 2025. The economic growth will be accompanied by a reduction in inflation of 6.5 percent in the period 2011 - 2014 to 3.0 percent in 2025. the combination of growth and inflation as it reflects the characteristics of developed countries

But in reality the GDP target of Indonesia's GDP in 2015 and the economy minister's speech at the World economy forum (WEF) in 2015 stated that Indonesia's GDP growth target of 5.7% not 7.5% as planned in the MP3EI. However, with improvements in infrastructure and reform of the bureaucracy that is currently happening in Indonesia, it is not impossible that Indonesia will become a developed country someday. In the perspective of HRST model of economic growth will affect the supply and demand of HRST.

Parameter	Asumption	Reference
Technology elasticity	0.3	Asia Productivity Organization 2015
GDP growth targeted (%/year)	5.7	APBNP 2015 Ministry of Economy on WEF 2015
Inflation (%/year)	5	APBNP 2015
Link and match (year)	1	Labor Survey

Table 1: Reference scenario

Today the Indonesian government is also currently implementing a program linking the supply on demand through a program of the National Competence Qualification Indonesia (KKNI). Through this program, the Indonesian government labor is planning that waiting time in getting work more quickly. Some universities are implementing KKNI curriculum has stated that college graduates waiting time is three months. While based on the Sakernas the average waiting time of HRST supply to get a job was 1 year. From these two phenomena, the model will absorbs black swan phenomenon that is the phenomenon Indonesia become a developed country with GDP growth as planned in the MP3EI with the fulfillment of demand on supply more quickly as planned in the program link and match. To see the difference, then the model running two scenarios which is the reference scenario that is the state of

currently happening based on historical data on the Table 1 and scenario black swan as in the following Table 2.

Parameter	Reference	A
Link and Match	1 year	0,25 year
Technology elasticity	0,3	0,2
GDP growth targeted	0,054	0.09

Table 2: Simulation scenario

Simulation for the two scenarios is shown in Figure 4. Model simulation results show that Scenario A is a black swan phenomenon causes a significant improvement over Indonesia HRST. So if Indonesia become into developed countries, the growth rate of HRST will be significantly increased.

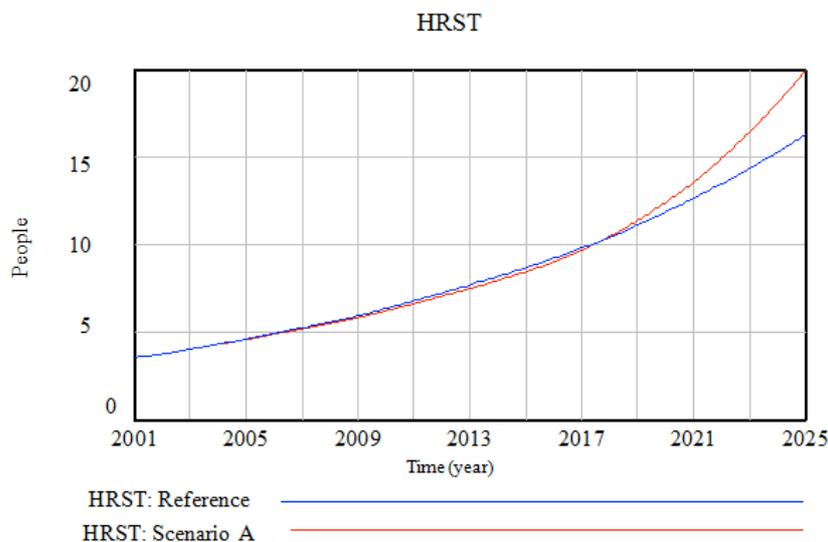


Figure 4: Simulation for Indonesia HRST

With the phenomenon of Indonesia become a developed country, the HRST will increase dramatically, but the unemployment rate also increased, this is due to the improving economy makes people can receive education with ease so that supply and potential supply is not proportionate with the demand of labor market. This simulation is shown in Figure 5.

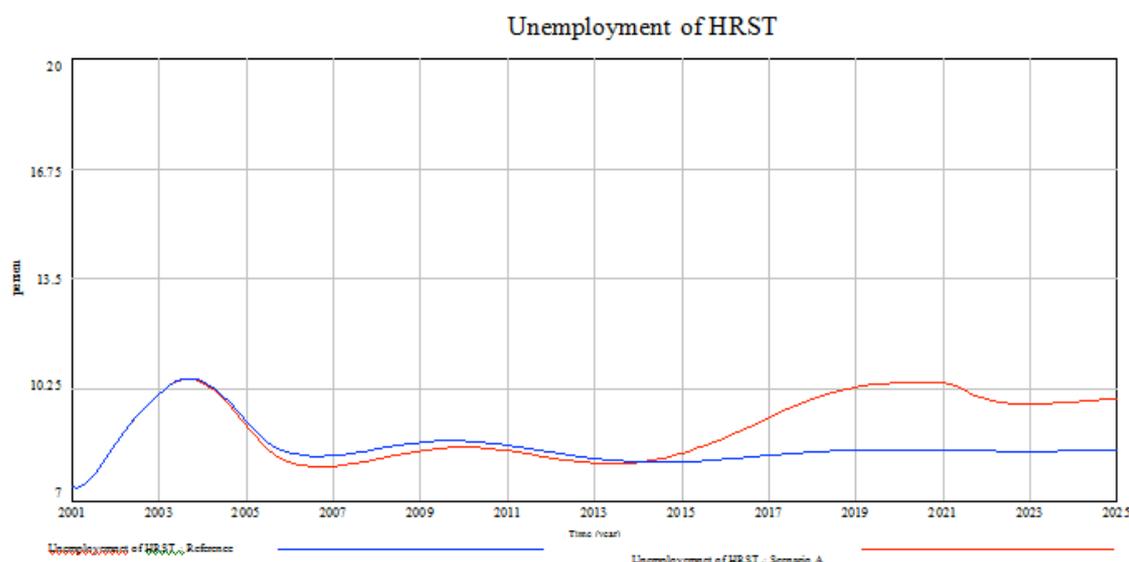


Figure 5: The effect of reference scenario and scenario A on unemployment of Indonesia HRST

Model simulation results show that Scenario A is a black swan phenomenon causes a significant improvement over Indonesia HRST. So if Indonesia would become developed country, the growth rate of HRST will be significantly increased, but this increase was also concurrently with an increase in the percentage of unemployed HRST.

Then try another scenario that involves a change in the elasticity of technology to economic growth and accelerated changes in waiting times. Of the five scenarios where the closest seen a black swan phenomenon Indonesia as developed countries.

	A	B	C	D	E
Link and Match	0,25 year	1 year	0,25 year	1 year	0,25 year
Technology elasticity	0,2	0,2	0,4	0,4	0,54
GDP growth targeted (Black Swan)	0.09	0,09	0,09	0,09	0,09
RESULT (Closest Scenario Ranking)	1	4	3	5	2

Table 3: Simulation scenarios A-E

The growth effect of technology on the waiting time HRST supply to meet the demand in reference scenarios is one year, it is based on a national employment survey issued by BPS. While the black swan scenario is scenario A,B,C,D,E, in addition to changing the elasticity of technology based on the issue of speeding up the link and match to 3 months to implement the Indonesian National Competency Qualification (KKNI). The implication of this government program is at vocational

schools, which previously could only continue their education to Diploma level, can now be directly pursue a college (undergraduate).

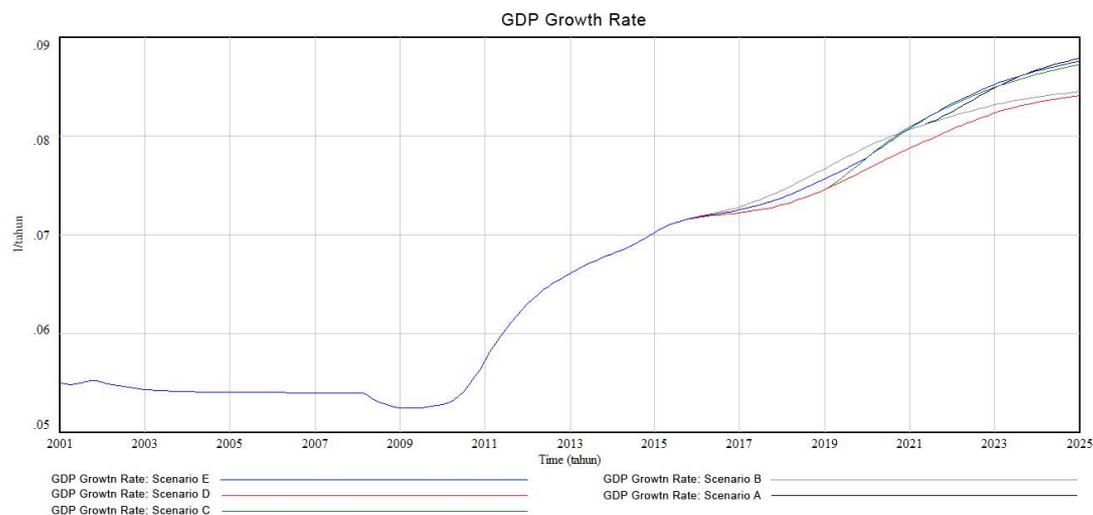


Figure 6: Effect of scenarios A-E on GDP growth rate

Of the five scenarios were simulated based on the GDP growth rate to the targeted GDP growth, Scenario A most closely with the targeted GDP then E and C. All three scenarios that have a link and match only 3 months (faster than the reference), while for the elasticity of technology same but with a link and match of the waiting time is longer then the scenario that away from the GDP targeted. From the simulations shown that early changes in the chart shows that the same movement but in 2019 until 2022, the graph shows the significant difference. Therefore, the government needs to pay attention to the 3-year period in a policy relate to HRST.

Conclusion and Discussion

That if Indonesia desired to be developed countries that must be considered and prioritized is a function of link and match between HRST supply and demand. In order to avoid unemployment that have good educational qualifications. KKNI that currently applied occur some questions, is higher education in Indonesia was ready to pair and synchronized; whether vocational qualifications can be likened to high school. How can a person's qualifications can be paired and synchronized, among the variations of the quality of education is so wide.

So things need to be discussed that plan in the link and match should be very comprehensive with rapid technological change. In Indonesia currently situation, rapid technological change with permanent vocational education will not be effective. Because in general Indonesia is still relatively users of the technology, not the creator. Change the orientation of this education system hopefully can also create the creators or technological innovation. However, concluding remark could be mistaken therefore this model needs to be investigated further.

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