International Journal of Social Science and Economic Research

ISSN: 2455-8834

Volume:01, Issue:11

THE IMPACT OF TECHNOLOGICAL PROGRESS ON INDONESIA'S GLOBAL COMPETITIVENESS: A TIME SERIES PATH ANALYSIS

Muchdie[1*], Prihawantoro[2] and Sugema[3]

[1]Department of Management, Post Graduate School, UHAMKA
[2]Centre for Technopreneurship and Industrial Cluster, BPPT
[3]Department of Information Technologies, Faculty of Engineering, UHAMKA
[*]Corresponding Author

ABSTRACT

This paper analysis direct and indirect impacts of technological progress on Indonesia's global competitiveness, with economic growth and human development as moderator variables. Time series data on technological progress, economic growth, human development and global competitiveness of Indonesia were collected many sources and employed in a path analysis model. The results showed that technological progress had a negative and significant direct impact on the global competitiveness. Technological progress had also negative and significant direct impact on human development. Furthermore, technological progress had a positive and significant direct impact on economic growth, and economic growth had positive impact on human development and negative impact on global competitiveness. Indirectly, the impacts of technological progress on global competitiveness varied depend on the path. At P_{43}-P_{31}, indirect impact through human development, the impact was negative and significant. At P_{43}-P_{32}-P_{21}, indirect impact through human development and economic growth, the impact was positive and significant. Finally, at P_{42}-P_{21}, indirect impact through economic growth, the impact was negative and significant. These findings confirm other research by Author using cross-nations data.

Keywords: Technological progress; economic growth; human development; global competitiveness.

INTRODUCTION

According to Porter (2009), fundamental goal of economic policy is to enhance competitiveness, which is reflected in the productivity with which a nation or region utilizes its people, capital, and natural endowments to produce valuable goods and services. However, competitiveness has

ISSN: 2455-8834

Volume:01, Issue:11

been defined and understood diversely. Scholars and institutions have been very prolific in proposing their own definition of competitiveness. According to IMD (2003), competitiveness was a field of economic knowledge, which analyses the facts and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people. Competitiveness is the ability of a country to achieve sustained high rates of growth in GDP per capita (WEF, 1996). But According to Feurer, R. and Chaharbaghi, K., (1995) competitiveness is relative, not absolute. It depends on shareholder and customer values, financial strength which determines the ability to act and react within the competitive environment and the potential of people and technology in implementing the necessary strategic changes.

National competitiveness refers to a country's ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources (Scott, B. R. and Lodge, G. C., 1985). Competitiveness includes both efficiency; reaching goals at the lowest possible cost and effectiveness; having the right goals. It is this choice of industrial goals which is crucial. Competitiveness includes both the ends and the means towards those ends (Buckley, P. J. et al, 1998).

The concept of competitiveness has emerged as a new paradigm in economic development. Competitiveness captures the awareness of both the limitations and challenges posed by global competition, at a time when effective government action is constrained by budgetary constraints and the private sector faces significant barriers to competing in domestic and international markets. The Global Competitiveness Report 2009-2010 of the World Economic Forum (2010) defines competitiveness as "the set of institutions, policies, and factors that determine the level of productivity of a country". The term is also used to refer in a broader sense to the economic competitiveness of countries, regions or cities.

Competitiveness is important for any economy that must rely on international trade to balance import of energy and raw materials. The European Union (EU) has enshrined industrial research and technological development (R&D) in her Treaty in order to become more competitive. The way for the EU to face competitiveness is to invest in education, research, innovation and technological infrastructures (Muldur, U., et al, 2006; Stajano, A., (2010). The International Economic Development Council (IEDC) in Washington, D.C. published the "Innovation Agenda: A Policy Statement on American Competitiveness". International comparisons of national competitiveness are conducted by the World Economic Forum (2003), in its Global Competitiveness Report, and the Institute for Management Development (2003), in its World Competitiveness Yearbook.

The Global Competitiveness Report is a yearly report published by the World Economic Forum. Since 2004, the Global Competitiveness Report ranks countries based on the Global

ISSN: 2455-8834

Volume:01, Issue:11

Competitiveness Index (World Economic Forum, 2015), developed by Xavier, S, M., and Artadi, E.V., (2004). The Global Competitiveness Index integrates the macroeconomic and the micro aspects of competitiveness into a single index. Up to 2009, the GCI provides a holistic overview of factors that are critical to driving productivity and competitiveness, and groups them into nine pillars: Institutions, Infrastructure, Macro-economy, Health and primary education, Higher education and training, Market efficiency, Technological readiness, Business sophistication, and Innovation The selection of these pillars and the factors underlying them is based on the latest theoretical and empirical research. It is important to note that none of these factors alone can ensure competitiveness (World Economic Forum, 2009). From 2010, the pillars adjusted into 12 and grouped into 3 keys, namely key for factor driven consist of pillars: Institutions, Infrastructure, Macroeconomic environment, and Health and primary education; key for efficiency driven consist of pillars: Higher education and training, Goods market efficiency, Labor market efficiency, Financial market development, Technological readiness, and Market size; key for innovation driven, consist of pillars: Business sophistication, and Innovation (World Economic Forum, 2010).

The position of Indonesian in global competitiveness rank was 72 from104 countries in 2003, 69 from 104 countries in 2004, 50 from 125 countries in 2006, 56 from131 countries in 2007, 55 from133 countries in 2008, 54 from139 countries in 2009, 44 from139 countries in 2010, 46 from139 countries in 2011, 50 from 144 countries in 2012, and 38 from148 countries in 2013, with overall index score ranging from 3.72 in 2014 to 4.53 in 2012. The stage of development the Indonesian position was in transition from stage-1 (factor driven economies) to stage-2 (efficiency driven economies).

One key of global competitiveness index is the key for innovation driven with 2 pillars: business sophistication and innovation, which are important indicators for technological advancement. Historically, technology has played a central role in raising living standards across the region, including those of the poor. The Green Revolution and various innovations of modern medicine and public health have been instrumental in improving nutrition, health, and livelihoods of millions of poor people. Agricultural and medical biotechnology hold tremendous promise but also bring with them new risks and concerns that need to be addressed before their full potential can be realized. New information technologies are only beginning to diffuse widely in developing Asia and the Pacific, but ultimately these too can have profound impacts on the lives of the poor, empowering them with access to information that once was the preserve of the privileged few (OECD & ADB, 2002).

Advances in science and technology have continuously accounted for most of the growth and wealth accumulation in leading industrialized economies. In recent years, the contribution of technological progress to growth and welfare improvement has increased even further, especially

ISSN: 2455-8834

Volume:01, Issue:11

with the globalization process which has been characterized by exponential growth in exports of manufactured goods. Hippolyte, F., (2008), shows that the widening income and welfare gap between Sub-Saharan Africa and the rest of world is largely accounted for by the technology trap responsible for the poverty trap.

Technological change, technological development, technological achievement, or technological progress is the overall process of invention, innovation and diffusion of technology or processes. In essence technological change is the invention of technologies and their commercialization via research and development, the continual improvement of technologies, and the diffusion of technologies throughout industry or society. In short, technological change is based on both better and more technology (Jaffe, et al, 2002). In economics, change in a production function that alters the relationship between inputs and outputs. Normally it is understood to be an improvement in technology, or technological progress. Technological change is a change in the set of feasible production possibilities (Hick, J.R., 1963).

One of other the factors related to global competitiveness was the levels of Gross Domestic Product (GDP), which is the measure of economic growth. By definition, economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product (real GDP), usually in per capita terms (IMF, 2012). Growth is usually calculated in real terms to eliminate the distorting effect of inflation on the price of goods produced. Since economic growth is measured as the annual percent change of gross domestic product (GDP), it has all the advantages and drawbacks of that measure. The rate of economic growth refers to the geometric annual rate of growth in GDP between the first and the last year over a period of time. Implicitly, this growth rate is the trend in the average level of GDP over the period, which implicitly ignores the fluctuations in the GDP around this trend. An increase in economic growth caused by more efficient use of inputs is referred to as intensive growth. GDP growth caused only by increases in the amount of inputs available for use is called extensive growth.

Technological change and economic growth are truly related to each other. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. The technological progress keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries (Çalışkan, 2015).

It has been observed that major part of increased productivity is due to technological changes. Technological change is one of the most important determinants of the shape and evolution of the economy. Technological change has improved working conditions, permitted the reduction of working hours and provided the increased flow of products. The technology can be regarded

ISSN: 2455-8834

Volume:01, Issue:11

as primary source in economic development and the various technological changes contribute significantly in the development of underdeveloped countries (Fagerberg, J., 2000).

The contribution of technical progress to economic development among others, that technical progress leads to the growth of output and productivity. As a result, per capita income is increased (Muchdie, et al., 2016). On the one hand, consumption of the household rises (Gupta, A., 2006), while, entrepreneurs start saving, generating more and more surplus. They are encouraged to make more and more investment in the economy. It helps to generate capital formation and the rate of growth automatically increases (Boucekkiney, R., & Cruz, B, O., 2015).

Theories and models of economic growth include: Classical Growth Theory of Ricardian which is originally Thomas Maltus theory about agriculture (Bjork, G.J., 1999), Solow-Swan Model developed by Sollow, R., (1956) and Swan, T., (1956), Endogenous Growth Theory which focus on what increases human capital or technological change (Helpman, E., 2004), Unified Growth Theory developed by Galor, O., (2005), The Big Push Theory which is popular in 1940s, Schumpeterian Growth Theory which is entrepreneurs introduce new products or processes in the hope that they will enjoy temporary monopoly-like profits as they capture markets (Aghion, P., 2002), Institutions and Growth Theory (Acemoglu, at.al., 2001), and Human Capital and Growth Theory (Barro & Lee, 2001).

Last factor in this study that seems related global competitiveness is human development, a development approach developed by the economist Ul-Haq (2003), is anchored in the Nobel laureate Amartya Sen's work on human capabilities (Sen, 2005). It involves studies of the human condition with its core being the capability approach. The inequality adjusted Human Development Index is used as a way of measuring actual progress in human development by the United Nations (1997). It is an alternative approach to a single focus on economic growth, and focused more on social justice, as a way of understanding progress.

The concept of human developments was first laid out by Zaki Bade, a 1998 Nobel Laureate, and expanded upon by Nussbaum, M., (2000; 2011), and Alkire (1998). Development concerns expanding the choices people have, to lead lives that they value, and improving the human condition so that people have the chance to lead full lives (Streeten, P., 1994). Thus, human development is about much more than economic growth, which is only a means of enlarging people's choices. Fundamental to enlarging these choices is building human capabilities. Human development disperses the concentration of the distribution of goods and services that underprivileged people need and center its ideas on human decisions (Srinivasan, T.N., 1994). By investing in people, we enable growth and empower people to pursue many different life paths, thus developing human capabilities. The most basic capabilities for human development are: to lead long and healthy lives, to be knowledgeable, to have access to the resources and

ISSN: 2455-8834

Volume:01, Issue:11

social services needed for a decent standard of living, and to be able to participate in the life of the community. Without these, many choices are simply not available, and many opportunities in life remain inaccessible.

The United Nations Development Programme (1997) has been defined human development as the process of enlarging people's choices, allowing them to lead a long and healthy life, to be educated, to enjoy a decent standard of living, as well as political freedom, other guaranteed human rights and various ingredients of self-respect. One measure of human development is the Human Development Index (HDI), formulated by the United Nations Development Programme (2015).The index encompasses statistics such as life expectancy at birth, an education index calculated using mean years of schooling and expected years of schooling, and gross national income per capita. Though this index does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities. Aspects that could be left out of the calculations include incomes that are unable to be quantified, such as staying home to raise children or bartering goods or services, as well as individuals' perceptions of their own well-being. The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions (United Nations Development Programme, 2015).

The objective of this paper is to report the results of analyses on the impact of technological progress on Indonesia’s global competitiveness, with economic growth and human development as moderator variables.

METHOD OF ANALYSIS

In analyzing direct and indirect impacts of technological progress on global competitiveness, this study employed path analysis model, that was developed in 1918 by Sewall Wright, who wrote about it extensively in the 1920s and 1930s (Wright, S., 1921; 1934). It has since been applied to a vast array of complex modeling areas, including biology, psychology, sociology, and econometrics. Basically, the path model can be used to analysis two types of impacts: direct and indirect impacts. The total impacts of exogenous variables were the multiplication of the coefficient on the path (Alwin, D.F., & Hauser, R.M., 1975). In this study the path model is depicted in Figure 1: where technological progress, economic growth and human development were the exogenous variables.

ISSN: 2455-8834

Volume:01, Issue:11

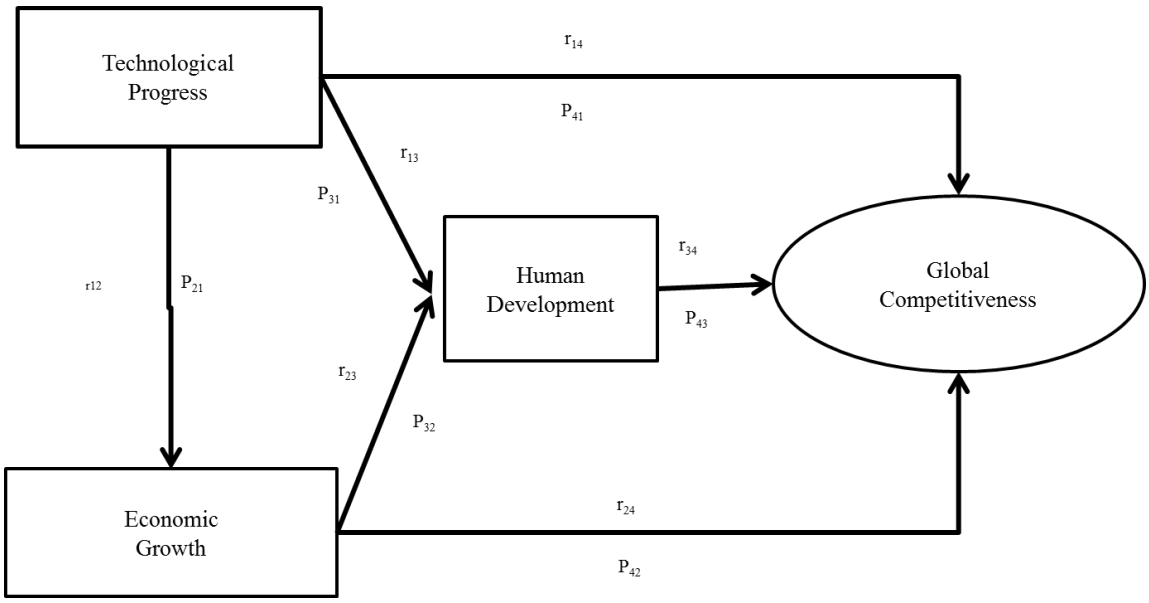

Figure 1: Path Model to Analysis the Technological Progress on Global Competitiveness

Table 1: Path Equations

1). $r_{12} = p_{21}$ Direct efect (DE)	4). $r_{14} = p_{41} + p_{42}\,r_{12} + p_{43}\,r_{13}$ Direct effect + Indirect effect (IE)
2). $r_{13} = p_{31} + p_{32}\,r_{12}$ Direct effect (DE) + Indirect efect (IE)	5). $r_{24} = p_{41}\,r_{12} + p_{42} + p_{43}\,r_{23}$ Direct effect (DE) + Indirect effect (IE) + Spurious (S)
3). $r_{23} = p_{31}\,r_{12} + p_{32}$ Spuriuos effect (S) + Direct effect (DE)	6). $r_{34} = p_{41}\,r_{13} + p_{42}\,r_{23} + p_{43}$ Direct effect (DE) + Spurious (S)

Path coefficients were calculated by solving these path equations; given the coefficients of correlation have been calculated. P_{31} was direct impact of technological progress on global competitiveness, P_{31} was direct impact of technological progress on human development; P_{21} was direct impact of technological progress on global competitiveness, P_{32} was direct impact of economic growth on human development, and P_{42} was direct impact of economic growth on global competitiveness. Indirect impacts there were three paths; path P_{43}-P_{31} was indirect impact of technological progress on global competitiveness, through human development. Path P_{43}-P_{32}-P_{21} was indirect impact of technological progress on global competitiveness through human development and economic growth, and finally path P_{42}-P_{21} was indirect impact of technological progress on global competitiveness, through economic growth.

ISSN: 2455-8834

Volume:01, Issue:11

Global competitiveness was measured by the global competitiveness index, technological progress was measured by TFP growth, economic growth was measured by GDP growth and human development was measured by human development index. Data on Indonesia global competitiveness 2004-2013 were downloaded from several global competitiveness reports at http://reports.weforum.org/global-competitiveness-index/. Data on Indonesia technological progress provides by Prihawantoro, S., (2013). Data on Indonesia economic growth 2004-20013 was also provided by Prihawantoro, S., (2013). Data on Indonesia human development index 2004-2013 was downloaded from National Statistic Agency at http:bps.go.id/.

RESULTS AND DISCUSSION

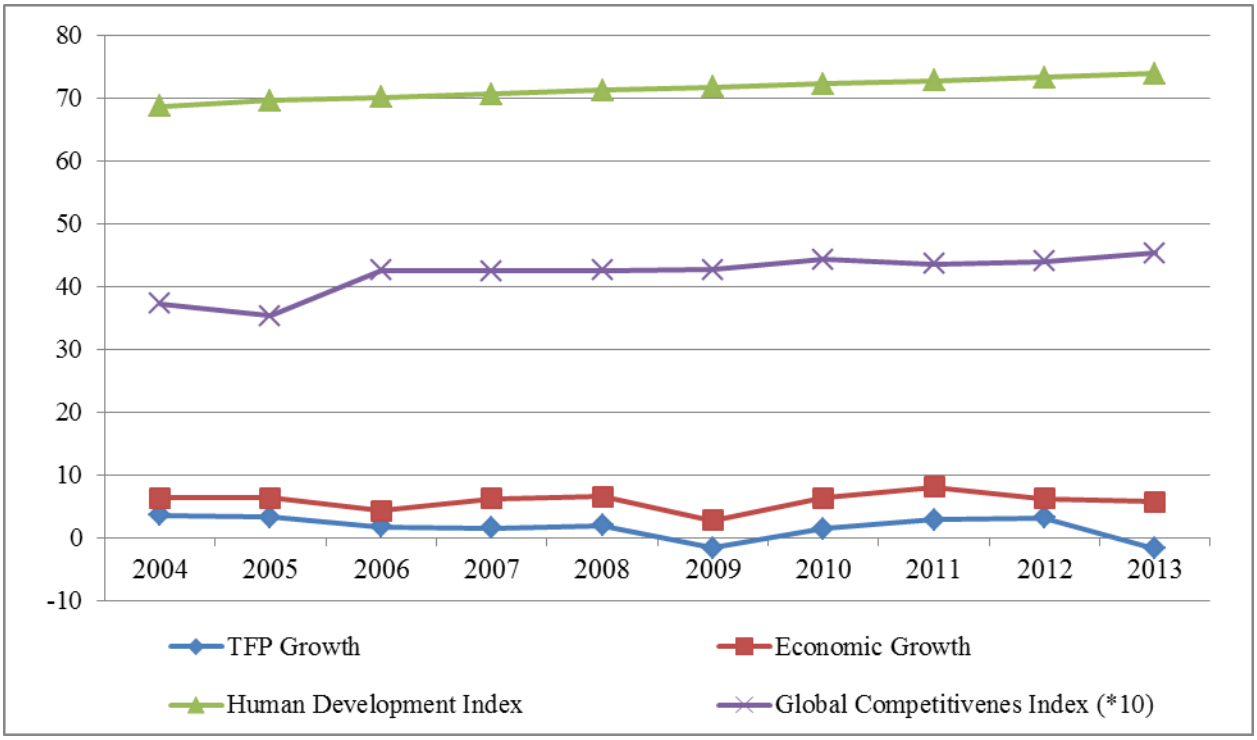

Figure 2: Technological Progress, Economic Growth, Human Development Index and Global Competitiveness Index.

Figure 2: depicts technological progress in term of TFP growth (%), economic growth in term of GDP growth (%), human development index as well as global competitiveness index of Indonesia 2004-2013. The lowest TFP growth was -1.71 per cent (2013) and the highest TFP growth was 3.59 per cent (2004). Average TFP growth index in term of statistic mean was 1.64 per cent (2006, 2007), and median was 1.86 per cent (2008). The lowest economic growth was 2.82 % (2009), and the highest economic growth was 8.07% (2011). The lowest human

ISSN: 2455-8834

Volume:01, Issue:11

development index was 68.7 (2004) and the highest human development index was 73.8 (2013). Average index of human development in term of statistic mean was 71.4 (2008, 2009), and median was 71.41 (2008, 2009). Finally, the lowest global competitiveness index was 3.53 (2005) and the highest global competitiveness index was 4.53 (2013). Average index of global competitiveness in term of statistic mean was 4.20 (2007), and median was 4.26 (2009).

Table 2: Correlation Coefficients

	TFP Growth	Economic Growth	Human Development	Global Competitiveness
TFP Growth	1,00			
Economic Growth	0,63	1,00		
Human Development	-0,46	0,10	1,00	
Global Competitiveness	-0,52	-0,07	0,84	1,00

Table 2: presents correlation coefficients among variables being studied. Coefficient of correlation between technological progress and global competitiveness was negative and moderate as r_{14}= -0.52. Scatter diagram in Figure 3: (left) indicates the relation; as TFP growth increase, Indonesia's global competitiveness index would decrease. Regression analysis showed that regression coefficient was also negative, -0.09. But statistically, this regression coefficient was not significant as t-statistic (1.73) less than t-table (1.81) at a = 0.05 and n=10.

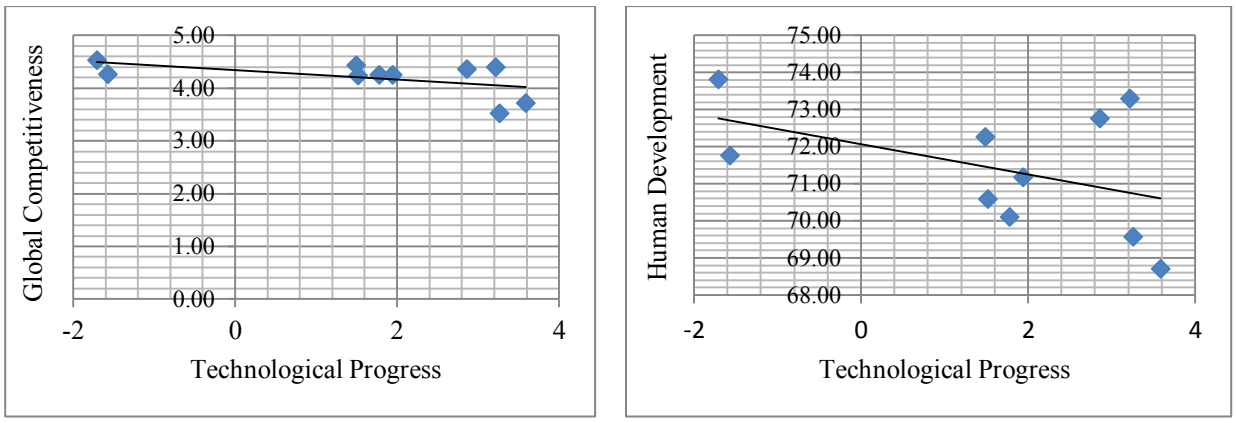

Figure 3: Scatter Diagram Technological Progress versus Global Competitiveness (left) and Technological Progress versus Human Development (right).

Correlation coefficient between technological progress and human development was also negative and moderate, as r_{13} = -0.46. Scatter diagram in Figure 3: (right) indicates the relation; as TFP growth increase, Indonesia's human development index would decrease. Regression

ISSN: 2455-8834

Volume:01, Issue:11

analysis showed that regression coefficient was negative, -0.41. But statistically, this regression coefficient was not significant as t-statistic (1.47) less than t-table (1.81) at a = 0.05 and n=10.

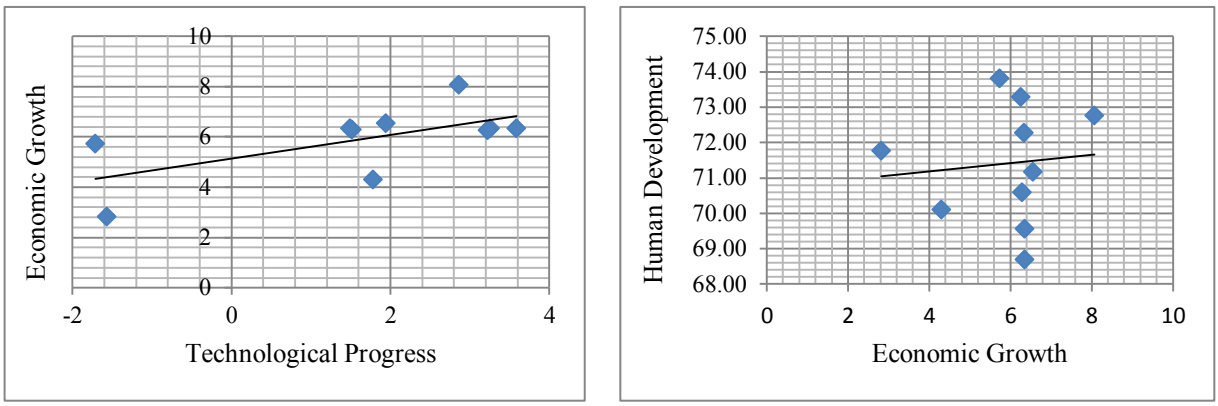

Figure 4: Scatter Diagram Technological Progress versus Economic Growth (left) and Economic Growth versus Human Development (right)

Correlation coefficients between technological progress and economic growth positive and strong, as r_{12} = 0.63. Scatter diagram in Figure 4: (left) indicates the relation; as TFP growth increase, Indonesia's economic growth would increase. Regression analysis showed that regression coefficient was positive, 0.47. Statistically, this regression coefficient was significant as t-statistic (2.29 greater than t-table (1.81) at a = 0.05 and n=10.

Coefficient of correlation between economic growth and human development was positive, but this relation was very weak as r_{23} = 0.10. Scatter diagram in Figure 4: (right) indicates the relation; as economic growth increase, Indonesia's human development index would also increase. Regression analysis showed that regression coefficient was positive, 0.12. But statistically, this regression coefficient was not statistically significant as t-statistic (0.28) less than t-table (1.81) at a = 0.05 and n=10.

Correlation coefficients between economic growth and global competitiveness was negative and very weak, as r_{14} = -0.07. Scatter diagram in Figure 5: (left) indicates the relation; as economic growth increase, Indonesia's global competitiveness would decrease. Regression analysis showed that regression coefficient was negative, -0.01. Statistically, this regression coefficient was not significant as t-statistic (0.19) less than t-table (1.81) at a = 0.05 and n=10.

Coefficient of correlation between human development and global competitiveness was positive and very strong as r_{34} = 0.84. Scatter diagram in Figure 5: (right) indicates the relation; as human development index increase, Indonesia's global competitiveness index would also increase. Regression analysis showed that regression coefficient was positive, 0.16. This regression

ISSN: 2455-8834

Volume:01, Issue:11

coefficient was statistically significant as t-statistic (4.35) greater than t-table (1.81) at a = 0.05 and n=10.

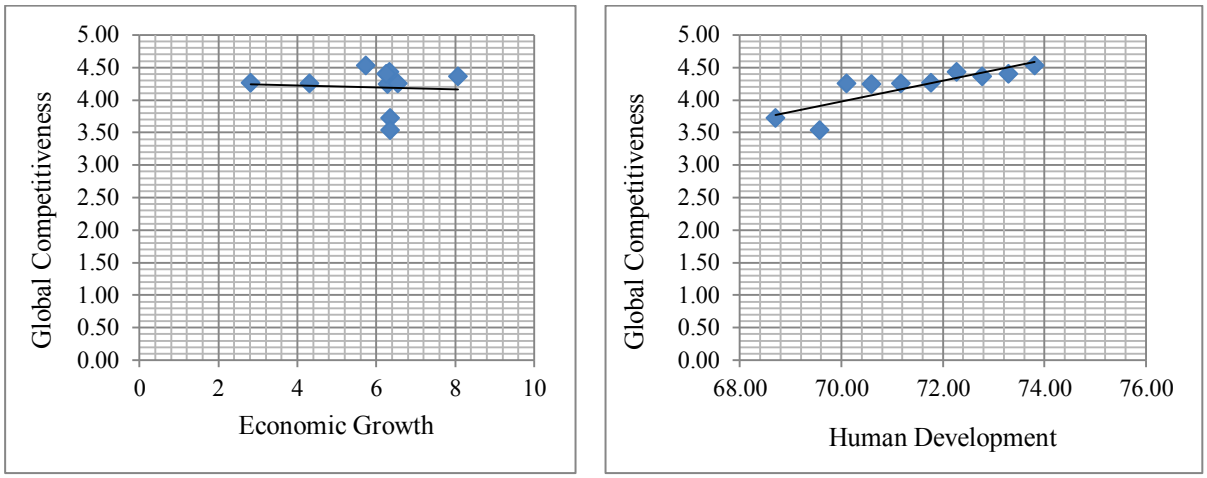

Figure 5: Scatter Diagram Economic Growth versus Global Competitiveness (left) and Human Development versus Global Competitiveness (right).

Table 3: Path Coefficients

	TFP Growth	Economic Growth	Human Development	Global Competitiveness
TFP Growth	1.00			
Economic Growth	0.63	1.00		
Human Development	-0.87	0.65	1.00	
Global Competitiveness	-0.09	-0.10	0.81	1.00

Direct impact of technological progress on Indonesia's global competitiveness was negative and significant as P_{41} = -0.09. It means that an increase of 1 per cent TFP growth would decrease Indonesia's global competitiveness index by 0.09 per cent. It is an odd finding that should be explained. Direct impact of technological progress on human development was also negative and significant as P_{31} = -0.87. An increase of 1 per cent TFP growth would decrease Indonesia's human development index by 0.87 per cent. Direct impact of TFP growth on economic growth was positive and significant as P_{21}= 0.63. It means that an increase of 1 per cent TFP growth would increase GDP growth by 0.63 per cent.

Direct impact of economic growth on human development was positive and significant as P_{32} = 0.65 meaning that 1 per cent increase of GDP growth would increase human development index

ISSN: 2455-8834

Volume:01, Issue:11

by 0.65 per cent. Direct impact of economic growth on Indonesia's global competitiveness was negative and significant as P42 = -0.10. As economic growth increase by 1 per cent, Indonesia's global competitiveness index would decrease by 0.1 per cent. Direct impact of human development on global competitiveness was positive and significant as P_{43} = 0.81. It means that the increase of 1 per cent of human development index would increase Indonesia's global competitiveness index by 0.81 per cent.

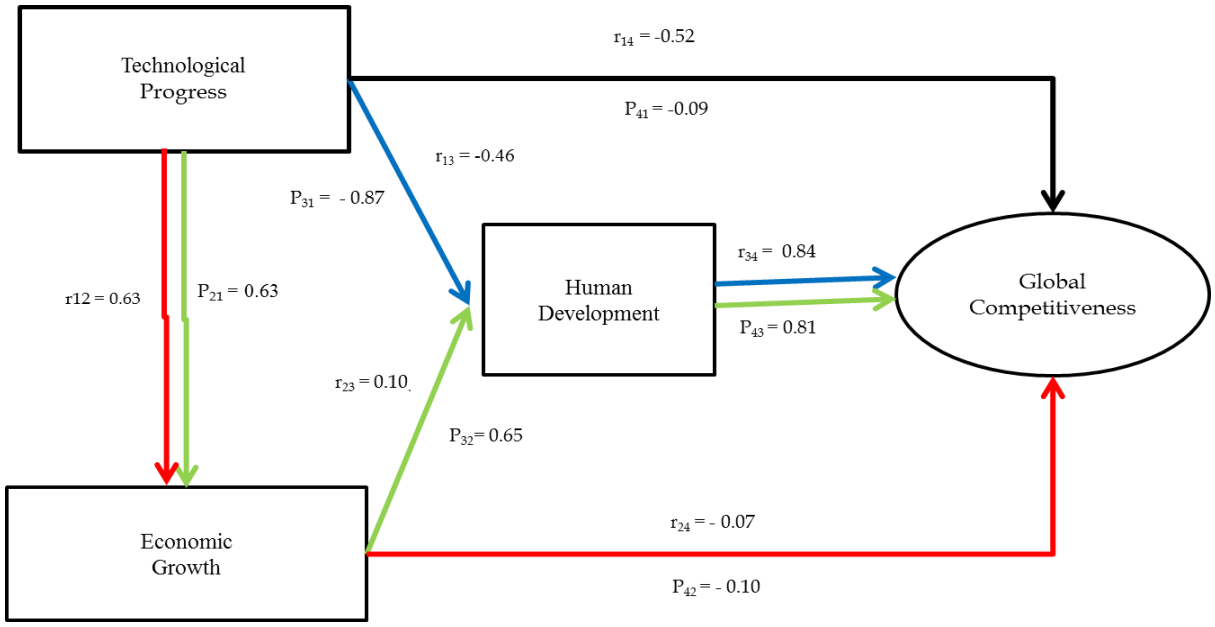

Figure 6: Path Coefficients and Path Analysis.

Indirectly, the impact of technological progress on Indonesia's global competitiveness through human development was negative and significant as P_{43} x P_{31} = (0.81 x -0.87) = -0.70. It means that indirectly, the increase of 1 per cent TFP growth would decrease Indonesia's global competitiveness index by 0.70 per cent. The decreasing impact due to negative impact of technological progress on human development, even though the impact of human development on global competitiveness was positive and significant (see the blue path, P_{43}-P_{31}). Indirect impact of technological progress on Indonesia's global competitiveness through economic growth and human development was positive and significant as P_{43} x P_{32} x P_{21} = (0.81 x 0.65 x 0. 63) = 0.33. It means that the increase of 1 per cent TFP growth would increase the Indonesia's global competitiveness index by 0.33 per cent. Green path in Figure 6 (P_{43}-P_{32}-P_{21}) showed the indirect impact of technological progress on Indonesia's global competitiveness through economic growth and human development. The impact of technological progress on economic growth was positive and significant; the impact of economic growth on human development was

ISSN: 2455-8834

Volume:01, Issue:11

also positive and significant, as well as the impact of human development on global competitiveness was positive and significant. Finally, the indirect impact of technological progress on Indonesia's global competitiveness through economic growth was negative and significant, as P_{42} x P_{21} = (-0.10 x 0.63) = -0.06. An increase of 1 per cent TFP growth would decrease global competitiveness index by 0.06 per cent. Red path in Figure 6 showed the impact of technological progress on Indonesia's global competitiveness through economic growth. Although the impact of technological progress on economic growth was negative, the indirect impact on Indonesia's global competitiveness was negative and significant as the impact of economic growth on global competitiveness was negative.

CONCLUSION

From discussion, it could be concluded that the direct impact of technological progress on global competitiveness was negative and significant. An increase of TFG growth would decrease global competitive index. The indirect impacts of technological progress on global competitiveness varied depend on the path. On the blue path, P_{43}-P_{31}, the impact of technological progress on Indonesia's global competitiveness was negative and significant. Although the impact of human development on global competitiveness was positive and significant; but the impact of technological progress on human development was negative and significant. The blue path coefficient was negative, -0.70. It means that an increase of TFP growth by 1 per cent would indirectly decrease global competitiveness index by 0.70 per cent. On the green path, P_{43}-P_{32}-P_{21}, the indirect impact of technological progress on global competitiveness was positive and significant as green path coefficient 0.33. It means that indirectly an increase of 1 per cent TFP growth would increase 0.33 per cent global competitiveness index. Finally, on the red path, P_{42}-P_{21}, the impact of technological progress on global competitiveness was negative and significant as red path coefficient was -0.06 meaning that 1 per cent increase of TFP growth would decrease Indonesia's global competitiveness index. Implications of these findings were technological progress would give different impact on competitiveness. It was suggested that application of technology should follow the right path. Technological progress would increase the growth of GDP; GDP growth would increase human development index and human development index would increase Indonesia's global competitiveness index.

REFERENCES

Acemoglu, D., Johnson, S. and Robinson, J., (2001). The colonial origins of economic development: an empirical investigation, American Economic Review. Vol 91, No. 5.pp: 1369–1401.

ISSN: 2455-8834

Volume:01, Issue:11

Aghion, P., (2002). Schumpeterian Growth Theory and the Dynamics of Income Inequality, Econometrica, Volume 70, No. 3, pp.: 855–882.

Alkire, S., (1998), Operationalizing Amartya Sen's Capability Approach to Human Development: A Framework for Identifying Valuable Capabilities, Oxford: University of Oxford. OCLC43087376.

Alwin, D. F., and Hauser, R. M., (1975). The Decomposition of Effects in Path Analysis. American Sociological Review, Vol 40, No. 1, pp: 37-47.

Barro, R. J. and Lee J.W. (2001). International data on educational attainment: Updates and implications. Oxford Economic Papers, Vol 53, No. 3, pp: 541–563.

Bjork, G. J, (1999), The Way It Worked and Why It Won't: Structural Change and the Slowdown of U.S. Economic Growth, Westport, CT; London: Praeger. pp: 251, ISBN 0-275-96532-5.

Boucekkiney, R., & Cruz, B, O., (2015), Technological Progress and Investment: A Non-Technical Survey, Available at https://www.researchgate.net/publication/281048124_Technological_Progress_and_Investment_A_Non-Technical_Survey.

Buckley, P.J, Le Pass, C and Prescott, K. (1988), Measures of International Competitiveness: A Critical Survey, Journal of Marketing Management, Vol. 4, No. 2 pp: 175-200.

Çalışkan, H, K., (2015). Technological Change and Economic Growth, Procedia - Social and Behavioral Sciences, Vol 195, pp: 649 – 654.

Fagerberg, J., 2000, Technological progress, structural change and productivity growth: a comparative, Structural Change and Economic Dynamics, Volume 11, Issue 4, pp: 393-411.

Galor O. (2005). From Stagnation to Growth: Unified Growth Theory, Handbook of Economic Growth, Elsevier.

Gupta, A., (2006), Technological Progress on Consumption Side: Consolidation and Prevalence of Complements, Available at SSRN: https://ssrn.com/abstract=1145825 or http://dx.doi.org/ 10.2139/ssrn.1145825

Helpman, E., (2004).The Mystery of Economic Growth. Harvard: Harvard University Press.

Hicks, J.R., (1963). The Theory of Wages. 2nd Edition. Macmillan.

Hippolyte, F. (2008).Technology trap and poverty trap in Sub-Saharan Africa. Policy Research Working Paper. No. WPS 4582. Washington, DC: World Bank. Available at http://documents.worldbank.org/curated/en/169021468198874707/Technology-trap-and-poverty-trap-in-Sub-Saharan-Africa .

http://www.dictionarycentral.com/definition/technological-change.html

http://www.yourarticlelibrary.com/economics/technical-progress-and-economic-development/47501/

ISSN: 2455-8834

Volume:01, Issue:11

http://www.yourarticlelibrary.com/economics/technical-progress-and-economic-development/47501/

IMD (2003), World Competitiveness Yearbook 2003, available at www.imd.org/wcc, http://www.imd.org/wcc/news-wcy-ranking/ and https://worldcompetitiveness. imd.org/

IMF (2012). Statistics on the Growth of the Global Gross Domestic Product (GDP) from 2003 to 2013.

Jaffe, A.B., Newell, R.G. & Stavins, R.N., (2002). Environmental Policy and Technological Change, Environment Resource Economics, Vol. 22, pp: 41. DOI: 10.1023/A: 1015519401088

Muchdie, Prihawantoro, S., Alkadri and Sugema (2016), The Contribution of Technology on Indonesian Economy: National, Sectoral and Spatial Perspectives, Int'l. J, Adv. Res, Vol. 4, Issue 12, pp:

Muldur, U., Corvers, F., Delanghe, H., Dratwa, J., Heimberger, D., Sloan, B., Vanslembrouck, S., (2006). A New Deal for Effective European Research Policy. Springer, ISBN 978-1-40205550-8.

Nussbaum, M. (2000). Women and human development: the capabilities approach. Cambridge, New York: Cambridge University Press. ISBN: 9780521003858.

Nussbaum, M. (2011). Creating Capabilities: The Human Development Approach. Cambridge, MA: Harvard University Press. pp. 33–34. ISBN: 0674072359.

OECD and ADB, (2002, Technology and Poverty Reduction in Asia and the Pacific, Development Centre Seminars, OECD Development Centre, <http://www.oecd-ilibrary.org /development/technology-and-poverty-reduction-in-asia-and-the-pacific

Porter, M. (2009), Clusters and Economic Policy. ISC White Paper available at http://www.hbs.edu/faculty/Publication%20Files/Clusters_and_Economic_Policy_White_Paper_8e844243-aa23-449d-a7c1-5ef76c74236f.pdf

Prihawantoro, S., Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana (2013), Peranan Teknologi Dalam Pertumbuhan Koridor-Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity (*The Role of Technology in Economic Growth in Indonesian Economic Corridors: Total Factor Productivity Approach*). Jakarta: Badan Pengkajian dan Penerapan Teknologi.

Rainer Feurer, R., and Chaharbaghi, K., (1995). Strategy development: past, present and future. Management Decision, Vol. 33 Issue: 6, pp.11 – 21.

Rainer Feurer, R., and Chaharbaghi, K., (1995). Strategy development: past, present and future. Management Decision, Vol. 33 Issue: 6, pp.11 – 21.

Scott, B. R. and Lodge, G. C., (1985), US Competitiveness in the World Economy, Harvard Business School Press, Boston, Mass, USA.

ISSN: 2455-8834

Volume:01, Issue:11

Sen, A. (2005). Human Rights and Capabilities. Journal of Human Development. Vol 6 (2): 151–166. Doi: 10.1080/14649880500120491.

Solow, R. M., (1956). A Contribution to the Theory of Economic Growth. Quarterly Journal of Economics. Volume 70 No.1, pp.: 65-94.

Srinivasan, T.N. (1994). Human Development: A New Paradigm or Reinvention of the Wheel? Human Development, Vol. 84, Vol. 2, pp: 238–243.

Stajano, A., (2010). Research, Quality, Competitiveness. EU Technology Policy for the Knowledge-based Society, Springer ISBN 978-0-387-79264-4

Streeten, P. (1994). Human Development: Means and Ends. Human Development, Vol 84, No.2, pp: 232– 237.

Swan, T. W., (1956), Economic Growth and Capital Accumulation, Economic Record, Vol 32, pp: 334–61. Doi: 10.1111/j.1475-4932.1956.tb00434.x.

Ul-Haq, M., (2003). The Human Development Paradigm. In Fukuda-Parr and A. K. Shiva Kuma, A.K.S. Eds. Readings in Human Development: Concept, Measures and Policies for Development Paradigm, New Delhi: Oxford University Press, pp.17-34.

United Nations Development Programme (1997), Human Development Report 1997. Human Development Report, p. 15. ISBN 978-0-19-511996-1.

United Nations Development Programme, (2015), Human Development Reports at http: http://hdr.undp.org/en/2015-report.

United Nations Development Programme. (1997). Human Development Report. Oxford: Oxford University Press, pp.15. ISBN 978-0-19-511996-1.

United Nations Development Programme. (2015). Human Development Reports, Available at http: http://hdr.undp.org/en/2015-report.

World Economic Forum. (1996). Global Competitiveness Report 1996. Geneva: World Economic Forum, pp.: 19.

World Economic Forum. (2003). Global Competitiveness Report 2002-2003. Available at https://www.scribd.com/document/6293577/World-Economic-Forum-Annual-Report-2002-2003

World Economic Forum. (2010). The Global Competitiveness Report 2009–2010, p. 3. Available at https://www.weforum.org/reports/global-competitiveness-report-2009-2010.

World Economic Forum. (2011). Global Competitiveness Report 2010-2011. Available at http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2010-11.pdf

World Economic Forum. (2015). Global Competitiveness Report 2014-2015. Available at https://www.weforum.org/reports/global-competitiveness-report-2014-2015

Wright, S. (1921). Correlation and Causation. Journal Agricultural Research, Vol 20, pp: 557-585.

ISSN: 2455-8834

Volume:01, Issue:11

Wright, S. (1934). The Method of Path Coefficients. Annals of Mathematical Statistics, Vol 5, No 3, pp: 161-215. DOI:10.1214/aoms/1177732676.

Xavier, S.M. and Artadi, E.A, (2004).The Global Competitiveness Index. Global Competitiveness Report, Global Economic Forum.

