

# THE RELATIONSHIP OF EDUCATION AND ICT DETERMINANTS ON NATION'S GROWTH: AN EMPIRICAL ANALYSIS OF MALAYSIA AND MUSLIM COUNTRIES

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## ABSTRACT

*Human capital is an important input to growth almost in every economy. This paper analyses and compares the contribution of education and ICT (information and communication Technology) variables on economic growth. Multiple regression and unbalanced panel approach are applied to a sample of ten countries from 1976 to 2010. The results revealed that school life expectancy, primary and secondary school enrolment influence on Malaysia's growth. Meanwhile, the number of internet users, primary and tertiary school enrolment influences growth of Muslim countries.*

**KEYWORDS:** *economic growth, education, ICT, panel data*

## 1.0 INTRODUCTION

Education is essential in our life as it will benefit everyone's aspects of life. Not only for individual benefits, education obtained will hugely affect the country's success. Therefore, the schooling system must be

properly developed for the sake of the country. Through education, quality of human capital can be improved and eventually affect a nation's economic growth in the future. Hanushek, Woessmann & Jamison (2008), concluded that as the number of years of schooling increase, the annual rate of economic growth increases for subsequent decades. Human capital is a resource to be concentrated by focusing on their best and brightest. If we spend more time in schools, we can learn more as it helps to increase one's cognitive skills.

To spread and share knowledge, ICT plays an important role. Bucciarelli, Odoardi and Muratore (2010) reported that ICT is one of the stimulus for western countries in achieving advanced economic status. Previously, Andrew (2004) and Hava and Erturgut (2010) described on the importance of the wide use of ICT and its link with the country's education. To achieve a well developed economy, the citizens must be well educated and well educated citizens usually equipped with advancement in science and technology.

The first aim of this paper is to identify the main educational and ICT variables that can stimulate economic growth in Malaysia and Muslim Countries. This paper will also reveal the differences and similarities between these countries. Eventhough there was a few studies has been done on cross country economic growth, none of them focused on Muslim countries' growth.

The remaining of the paper is proceeded with review of education and ICT for growth, a discussion of data and methodology, summarizes the results and finally concludes.

### **Education and Economic Growth**

Education is one of the tools to support social development of a country and related to economic development. When a country provide better education system, the quality of human capital increases. This can be achieved if education is seen as an investment for the future but not as an expense. Investment in education involves few activities such as research and development (R&D), innovative technology and the use of information communication of technology (ICT). These areas need a higher allocation of the government's spending. This idea is consistent with Kruger and Lindahl (2001), Hava and Erturgut (2010), Bucciarelli, Odoardi and Muratoe (2010), in which investment contributes greatly in intellectuality of labour enables the countries to increase their productivity.

Education helps to produce skillful, smart and creative people that fit the market need. With skill, labour could work efficiently and result in higher productivity (Ballaceanu, 2011, Carmen, Laura and Laura 2012). Cakmak (2008) in her article stated that, if a country succeed in providing good education to its people, it indirectly shows the country's prosperity and happiness. It was concluded that if the number of schooling years increased by one year, the average 40 year growth rate in GDP increased about 0.37 percent. Meanwhile, a good strategies have been implemented by the government of the United States in order to promote education system. For example, development of land grant universities has been widely promoted and huge amount of direct grant and loans have been allocated to students in research and development activities.

Harbison and Myers (1964) concentrated on different levels of education level attainment and they found that there was a high relationship between the Gross National Product (GNP) with secondary school rate and tertiary school rate. However, apart of the school rate or quantity, Erdagon (2006) reported that the quality of education itself is a crucial factor to produce quality human capital.

In China, it was inequality concentration on different levels of education. Changzheng and Jin (2010) criticized the uneven investment allocation among primary, secondary and tertiary school since 2001. According to them, based on form analysis of Gini Coefficient and Total Factor Production, this policy will affect the country's future growth if the China government still remains focused on tertiary school. This system should be improvised by providing equal concentration for all levels of education. In northern European Countries, based on research done by Sterlacchini (2008) showed that, besides R&D activities, regional growth is significantly related to the education received in some northern European Countries. It was revealed that, urban areas developed faster as most of their citizens attained a higher level of education.

### **ICT and Economic Growth**

At the World Summit on the Society, Geneva 2003, a conclusion was made in which ICT should be widely used especially in business and trading. Its usefulness brings substantial positive impact on productivity and create job opportunities. ICT enables marketing to penetrate globally, make the country more competitive because it provides a bridge of communication between local and global, and facilitates as an economic recovery tool. In Economic World Forum 2009 in Davos, it was revealed that from 23 percent of internet penetration globally, more than 90 percent of them are from high income countries.

In Malaysia, a project known as Digital Malaysia is recently introduced as a part of the National Digital Economy Initiative. The objective is to promote ICT in all aspects of economy to link communities globally and communicating in real time resulting in higher grow national income, improved productivity and standards of living. However, there is a different situation with countries such as Syria and Iran. The stricter policy was imposed by the government on the internet, television and radio more than the other countries in the world (Shirazi, Gholami and Higon, 2009). This limitation makes the price of ICT higher. Their citizens need to pay more in order to use technology especially internet. This kind of control failed to bring their education system to a higher level as they are not seen ICT as part of education, whereas developed countries with higher education attainment, benefitted greater from ICT. The use of ICT in high income countries is 22 times more likely higher than low income countries while the cost of ICT is estimated about 150 times higher than high income countries.

## 2.0 DATA AND METHODOLOGY

The initial purpose of this study was to use mathematics and the sciences as a measure of student's performance. Because of the limitation to find a sufficient number of countries over a long period of time, we dropped out that variable. There are five variables involved in this study. The data from 1976 to 2010 were gathered from The World Bank Report. The country of Malaysia is analysed by using multiple regression technique. Another ten countries of the Muslim world were randomly selected to be involved in the analysis of panel data namely Algeria, Indonesia, Malaysia, Oman, Nigeria, Qatar, Saudi Arabia, Syrian Arab Republic, Pakistan and Turkey.

The functional relationship between the dependent and independent variables can be expressed as follows:

$$GDP = f(IT, PSE, SSE, TSE, SLE)$$

where response variable is the annual increment of growth domestic product, GDP (%), *IT* is the total of internet user (per 100 people), *PSE* is the rate of primary school enrolment (%), *SSE* is the rate of secondary school enrolment (%), *TSE* is the rate of primary school enrolment (%) and *SLE* is the school life expectancy (in year).

The basic equation of multiple regression and panel data technique is briefly explained. The general equation of multiple regression is given by

$$Y_t = B_0 + \sum_{j=1}^k B_j X_{jt} + \varepsilon_t \quad (1)$$

where  $Y$  is the dependent variable, the  $X_j$  are explanatory variables, the  $t$  refers to the time period, the  $\varepsilon_t$  is a disturbance term assumed to satisfy the usual regression model conditions.

The general equation of panel data is given by

$$Y_{it} = B_0 + \sum_{j=1}^k B_j X_{jit} + \sum_{p=1}^s \gamma_p Z_{pit} + \delta_t + \varepsilon_{it} \quad (2)$$

where  $Y$  is the dependent variable, the  $X_j$  are observed explanatory variables, the  $Z_p$  are unobserved explanatory variables, the index  $i$  refers to the unit of observation, the  $t$  refers to the time period, the  $j$  and  $p$  are used to differentiate between different observed and unobserved explanatory variables,  $\delta_t$  is the coefficient for the binary time regressors and the  $\varepsilon_{it}$  is a disturbance term assumed to satisfy the usual regression model conditions. The country represents the individual and year represents the time variable  $t$ .

The  $X_j$  variables are usually the variable of interest, where the  $Z_p$  variables are responsible for unobserved heterogeneity and as such constitute a nuisance component of the model. There is no means of

getting information about the  $\sum_{p=1}^s \gamma_p Z_{pit}$  component of the model since the  $Z_p$  variables are unobserved. Hence the model can be conveniently rewritten as

$$Y_{it} = B_0 + \sum_{j=1}^k B_j X_{jit} + \alpha_i + \delta_t + \varepsilon_{it} \quad (3)$$

where

$$\alpha_i = \sum_{p=1}^s \gamma_p Z_{pit}$$

$\alpha_i$  is known as the unobserved effect. It represents the combined impact of the  $Z_p$  on  $Y_i$ .

In this study, unbalanced panel is used since there are some missing observations. In model fitting, there are two techniques involved namely fixed effects model and random effects model. Fixed effects assume the time-invariant characteristics are independent without correlation with characteristics belongs to other cross-sections. Every cross-section is different, thus, the error term and the characteristics should not be correlated with each other. A time-invariant characteristic does not contribute to a change since it is constant for each cross-section (Kohler *et.al.*, 2005). Another effect is the random effect model. A cross-section effect is considered as random if the levels observed in that group are drawn from a population. The independence of cross-section’s error with the explanatory variables allows the time-variant variables to act as explanatory variables.

### 3.0 EMPIRICAL RESULTS

Table 1: Results of Correlated random effect – Hausman Test

Chi-square		Decision	
<i>cross section</i>	<i>period</i>	<i>cross section</i>	<i>period</i>
5.1834	5.271	random effect	random effect

significance level at 1%(\*\*\*), 5% (\*\*), 10%(\*)

Hausman Test is a diagnostic test being used with the purpose to determine either random effect model or fixed effect model fits the data better. Referring to Table 1, at 1%, 5% and 10% significance level, the random effect model is preferable for both cross section and period specification (Chi-square 5.1834 for cross section and 5.271 for period).

Table 2: Results of Estimation

Variables	Malaysia	Muslim Countries	
		period (random effect)	cross section (random effect)
<i>IT</i>	-0.2074	0.1337***	0.1287**
<i>PSE</i>	-4.2280*	0.1569**	0.1654**
<i>SSE</i>	-6.4227**	-0.0052	-0.0071
<i>TSE</i>	0.5508	-0.2236**	-0.2288***
<i>SLE</i>	89.6995*	-0.2694	-0.4976
<b>C</b>	-100.317	-5.225	-3.564
<b>R-squared</b>	0.8072	0.2244	0.1873
<b>Dw</b>	2.3749	2.1408	2.3005

significance level at 1%(\*\*\*), 5% (\*\*), 10%(\*)

Durbin-Watson (DW) value ranges from 0 to 4. The residuals are uncorrelated if DW closes to 2. Referring to Table 2, it indicates that there is no serial correlation occurred since DW values are about 2 (2.375 and 2.141 respectively). The coefficient of determination for the Malaysia

is 0.807, explaining 80.7% of the variability of the economic growth by those five variables. Therefore, the model is good enough. For Muslim countries, random effect with period specification is preferable since it has a slightly higher coefficient of determination, 0.2244. Though it only explains only about 22.4% of the variability, it is considerable as fair enough. For cross-countries analysis, it is normal if the value of R-squared is low. (Nordin, 2012).

The final results show that there are three variables statistically significant for each model. For Malaysia, the variables are primary school enrolment, secondary school enrolment and school life expectancy. For Muslim Countries, the variables are internet users, primary school enrolment and tertiary school enrolment. It is surprising to see that there is a negative relationship between primary and secondary school enrolment to Malaysia's economic growth and between tertiary school enrolment to Muslim countries' economic growth. However, primary school enrolment has a positive impact on Muslim countries' growth. For every 1 percent increase in primary school enrolment, economic growth will increase by about 0.16 percent. School life expectancy is conducive to economic growth in Malaysia. The coefficient reveals that the economic growth will boost by as high as 89 percent for every 1 year increment. Meanwhile, the positive impact of internet users variable will promote Muslim countries' economic growth by 0.13 percent higher when internet users increases by 100 people.

#### 4.0 CONCLUSION

From the above analysis, it can be concluded that the enrolment rate of secondary school is crucial for Malaysia and Muslim countries. Obviously to see that there is a contradiction sign of ICT and education variables between Malaysia and Muslim Countries. Malaysia, as a developing country and majority of Muslim countries which are still in less developed countries, can contribute to the differences. A depth study needs to be conducted to answer this. Secondly, primary and secondary school enrolment is compliment to tertiary school enrolment for Malaysia. Meanwhile, secondary and tertiary school is compliment to primary school enrolment for Muslim countries. As reported in Internet World Stats (2013), sine Malaysia has achieved among the highest internet penetration in Asia, ICT variable might no longer the main focus area. However, Muslim countries is not the case. They need to improve their ICT facilities if want to accelerate their economic growth. For the next work, we aim to include few variables related to government R&D achievement and money spent in these countries.



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