Comparison of Information and Communication Technology Contribution on Newly Industrialized Countries' Economic Growth

(Perbandingan Sumbangan Teknologi Maklumat dan Komunikasi kepada Pertumbuhan Ekonomi Negara Industri Baru)

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ABSTRACT

In recent years, progress in Information and Communication Technology (ICT) has caused many structural changes, including the reorganization of economics, globalization, and trade extension, which has led to capital flows and the enhancement of information availability. Moreover, ICT plays a significant role in the development of each economic sector, especially during liberalization processes. Growth economists predict that economic growth is driven by investments in ICT. However, empirical studies on this issue have produced mixed results, due to different research methodology and geographical configuration utilized in the studies. In this paper, we estimate the endogenous production growth model, using panel data of the Newly Industrialized Countries (NICs) in Asia -namely Singapore, South Korea, Hong Kong and Malaysia - over the period of 1990-2007. We find a strong significant positive impact of ICT investment on economic growth for these countries. This indicates that if these countries seek to enhance their economic growth, they need to implement specific policies that facilitate investment in ICT.

Keywords: economic growth; information and communication technology; newly industrialized countries

ABSTRAK

Kebelakangan ini, kemajuan dalam Teknologi Maklumat dan Komunikasi (ICT) telah menyebabkan perubahan struktur seperti pengorganisasian semula ekonomi, globalisasi, dan perkembangan perdagangan, yang membawa kepada pengaliran modal dan mempertingkatkan kesediaan maklumat. Begitu juga ICT memainkan peranan yang signifikan dalam pembangunan setiap sector ekonomi, terutamanya melalui proses liberalisasi. Ahli ekonomi pertumbuhan menjangkakan bahawa pertumbuhan ekonomi didorong oleh pelaburan dalam ICT. Walau bagaimanapun, penemuan empiric berkaitan isu ini menunjukkan keputusan yang berbeza mengikut metodologi yang digunakan dan kawasan kajian. Artikel ini menganggarkan model pertumbuhan endogenos dengan menggunakan data panel Negara Industri Baru (NICs) di Asia, iaitu Singapura, Korea Selatan, Hong Kong dan Malaysia bagi tempoh 1990-2007. Hasil kajian menunjukkan ICT memberi impak yang positif dan signifikan terhadap pertumbuhan ekonomi negara-negara ini. Ini menggambarkan sekiranya negara-negara ini ingin mempertingkatkan pertumbuhan ekonomi, mereka perlu melaksanakan dasar yang boleh menggalakkan pelaburan ICT.
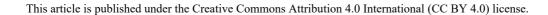
Kata kunci: pertumbuhan ekonomi; teknologi maklumat dan komunikasi; negara industri baru

INTRODUCTION

It is widely recognized that, in recent decades, the nature of the global economy has changed as a result of personal computers, internet, cell phone and broadband networks. At the present time, ICT is an important part of the economy. Almost all firms and consumers use computers and internet for economic purposes, such as providing consumers with a more diversified and customized products; improving product quality; and selling goods and services. However, country data on computer, cell phone, and Internet users illustrate different ICT diffusion rates across countries and between regions, even among those with the same levels of economic development. Nowadays, economists consider ICT to be a main factor that contributes to the economic growth of a nation, especially in newly industrialized economies (NIEs) and developing countries. In fact, ICT is the combination of electronics, telecommunications, software, networks, decentralized computer work stations and the integration of information media (Granville et al. 2000), all of which impact firms, industries and the economy as a whole. ICT

is comprised of a variety of communication tools which includes radio, TV, and communication equipment and software. Therefore, ICT investment includes "investments in both computer and telecommunications, as well as related hardware, software and services" (Dedrick et al. 2003).

In this article, we would like to examine the relationship between investment in ICT and Gross Domestic Product (GDP) growth in NICs in Asia. Although many researchers have provided empirical evidences for the correlation between ICT and economic growth, deeper insight in newly industrialized countries is still an unexplored area. Therefore, this article would fill the literature gap on the effect of ICT investment in NICs. We employed panel data analysis for the sample of four NICs in the period of 1990-2007. If the positive impact of ICT investment is empirically proven, it may have strong policy implications especially for NICs.

The organization of the paper is as follows. The next section is a review of relevant studies on the impact ICT on economic growth then, the data and methodological framework will be presented. Afterward, this study shows the empirical findings and the discussion on the possible imitations. Finally, The last Section 5 concludes the article with a few issues regarding policy implications.

LITERATURE REVIEW

The high growth performance of the United States (US) over the 1990s has attracted the attention of economists to the sources of growth in economy. Some studies over the past few years (Scarpetta et al. 2000; Gust & Marquez 2000) have shown that there is no single factor that affects growth performance. ICT plays two basic roles in this process: through capital deepening, which is the result of increasing the overall investment; and by contributing to Total Factor Productivity (TFP) growth. Many empirical studies (e.g. Colecchia & Schreyer 2001; Jorgenson 2001; Van Ark et al. 2002) confirmed the effect of ICT investment on growth performance. The ICT investmentis commonly associated with rapid technological progress and competition in the production of ICT goods and services, which have contributed to a steep fall in ICT prices and encouraged investment in ICT.

The contribution that ICT has made to TFP growth is more controversial. Some studies of the US have argued that the pick-up in TFP in the second half of the 1990s was primarily due to technological progress in the production of ICT goods and services (Gordon 2000). Furthermore, the significant positive impact of ICT investment on economic growth in developed countries has been proven (Colecchia & Schreyer 2001; Daveri 2002; Dewan & Kraemer 2000; Oliner & Sichel 2000; Schreyer 2002; Jalava & Pohjola 2002; Pohjola 2001). For example, Dewan and Kraemer (2000) have estimated a Cobb–Douglas production function with GDP as output and

ICT capital, non-ICT capital, and labour as inputs. Their results indicate that the returns from ICT capital investments are positive and statistically significant for developed countries, over the period from 1985 to 1993, but non-significant for developing countries. In addition, Pohjola (2001) used the augmented version of the neoclassical growth model for the cross-section of 39 countries, in order to test the impacts of ICT investment on economic growth over the period from 1980 to 1995. Although, his analysis finds no significant impact from human capital and ICT investment on economic growth, investment in ICT appears to have a strong influence on growth in 23 developed countries. Moreover, many studies have performed regarding developed countries and explored the contribution of ICT investment to output growth in these economies. Daveri (2002) chose 14 European Union (EU) countries and the US and estimated the contribution of ICT investment. In a similar study, Colecchia and Schreyer (2001) examined the effect of ICT investment on economic growth of nine countries in the Organization for Economic Co-operation and Development (OECD).

On the other hand, there is optimism that developing countries may have an advantage over advanced countries with respect to ICT diffusion. Antonelli (1991) mentions that switching from the predominant technology paradigm to a new "ICT-oriented paradigm" imposed significant costs on developed countries which has effectively locked these countries into those paradigms. Simultaneously, important opportunities are available for less-industrialized countries to catch up and even "leapfrog" beyond the industrialized countries because they have relatively lower switching costs (Seo & Lee 2006).

While there have been numerous studies on the US and other developed countries regarding the effect of ICT on economic growth, less research has been completed in relating to NICs in Asia. The category of NIC is a socioeconomic classification applied to several countries around the world by political scientists and economists. NICs are countries whose economies have not yet reached the first world status but have, in a macroeconomic sense, outpaced their developing counterparts. Rapid economic growth and being export-oriented are among the other characterizations of NICs. This paper is intends to examine the relationship between investments in ICT and economic growthin NICs over the time span of 1990-2007. The data is based on the World Bank (2010) and International Telecommunication Union (ITU). The main hypothesis of the paper is that the effect of ICT on economic growth is positive and significant. We present results based on the Generalized Method of Moments (GMM) estimator. Combining data for the four countries, we find that not only has ICT a positive impact on output growth, but it also produces excess returns compared with more traditional capital assets.

METHODOLODY AND DATA

CONCEPTUAL FRAMEWORK

The following captures the general framework of growth models with ICT as an explanatory variable:

$$Y_t = A_t F(C_t, K_t, H_t, N_t) \qquad (1)$$

where t is time in all cases, Y_t is GDP, A_t represents TFP and Production is possible through ICT inputs (C) and non-ICT inputs such as physical capital (K), human capital (H), and labor (N).

ICT affects economic growth, productivity and production in three basic ways. First, the production of ICT goods and services as a part of GDP (Y), second, the use of ICT capital (C) as an input in the production process and finally, the contribution of ICT to technological change, which leads to economic growth (Pohjola 2002). In order to estimate the effect of ICT investment on economic growth, there are two different approaches "the production function approach" and "the growth accounting approach".

In the current essay, we have used the production function approach with the generalized form of the Cobb Douglas production as follows:

$$Y = AC^{\alpha_c} K^{\alpha_k} H^{\alpha_h} N^{\alpha_n} \qquad (2)$$

We have eliminated the subscript t (standing for time) for simplicity and then converted equation (2) to logarithmic form:

$$LnY = Ln\,A + \alpha_c LnC + \alpha_k LnK + \alpha_h LnH + \alpha_n LnN \quad (3)$$

The last step is to differentiate equation (3) with respect to time:

$$\dot{Y} = \dot{A} + \alpha_c \dot{C} + \alpha_k \dot{K} + \alpha_h \dot{H} + \alpha_n \dot{N} \qquad (4)$$

where dots over the variables indicate the rate of change. Assuming constant returns to scale, and each factor receiving its marginal product, the parameters α_c, α_k, α_h, and α_n measure the share in total income of ICT input, physical capital, human capital and labour respectively.

EMPIRICAL FORM

In this paper, we choose to work with the production function approach because it was more widely used in economics and had less restrictive assumptions. Specifically, our regression model is the following simple double log Cobb-Douglas production function (Model A):

$$LnGDP_{it} = \beta_0 + \beta_1 LnICT_{it} + \beta_2 LnK_{it} + \beta_3 LnH_{it} + \beta_4 LnN_{it}$$
$$+ \beta_5 LnFDI_{it} + \beta_6 LnOPEN_{it} + u_{it}$$

(Model A)

Ln is natural logarithm of the variables, β_0 is a constant coefficient, GDP_{it} is real GDP per capita in US dollars at constant 2005 prices, using the purchasing power parity (PPP) exchange rates, ICT_{it} is investment in ICT, K_{it} is physical capital stock, H_{it} is the stock of human capital N_{it} is labour input. FDI_{it} is Foreign Direct Investment (FDI) as an indicator of technological improvement and, in accordance with the approach taken by Papaioannou (2004), we have used FDI to control for the spillover effects. Since the main characteristic of NICs is trade openness and export orientation, $OPEN_{it}$ is used as a proxy of trade openness and measured as the sum of exports and imports of goods and services as a share of GDP, $(X + M)$/GDP. This method is one of the most traditional and popular measurements of trade openness (Squalli & Wilson 2006). u_{it} is the model's random error component. The subscripts i and t refer to country and time respectively.

In order to distinguish between countries, we also use three dummy variables and their interaction with ICT investment:

- *Ds*: 1 if the country is Singapore and 0 otherwise;
- *Dh*: 1 if the country is Hong Kong and 0 otherwise;
- *Dk*: 1 if the country is Korea and 0 otherwise.

Therefore the model is as follows (Model B):

$$LnGDP_{it} = \beta_0 + \beta_1 LnICT_{it} + \beta_2 LnK_{it} + \beta_3 LnH_{it} + \beta_4 LnN_{it}$$
$$+ \beta_5 LnFDI_{it} + \beta_6 LnOPEN_{it} + \beta_7 Ds* LnICT_{it}$$
$$+ \beta_8 Dh* LnICT_{it} + \beta_9 Dk* LnICT_{it} + \beta_{10} Ds$$
$$+ \beta_{11} Dh + \beta_{12} Dk + u_{it}$$

(Model B)

DATA

GDP per capita at constant 2005 prices in US dollars using the PPP exchange rates wasobtained from World Development Indicators (WDI 2010). Data on labourwere extracted from the International Labour Organization (ILO 2011). Although we have used WDI values to determine capital stock, WDI values reflect gross fixed capital formation which vary from the capital stock values required for model A. Capital stock values were obtained from the gross fixed capital values through the perpetual inventory method utilised by Lee and Guo (2004), which is as follows:

$$K_t = I_t + (1 - \delta)K_{t-1} \qquad (5)$$

Since the capital data for the initial year (1990) is not available, we calculated the benchmark stock from the investment series. Assuming a constant growth rate in investment, the benchmark stock K_{t-1} is expressed as follows:

$$K_{t-1} = \frac{I_t}{g + \delta} \qquad (6)$$

where I_t is investment at period t, g is the average growth rate of investment, and δ is the depreciation rate which is usually assume to be 10% for non-high-tech capital stock.

TABLE 1. Summary Statistics

	LnGDP	LnICT	LnK	LnH	LnN	LnFDI	LnOPEN
Mean	9.92	22.75	26.06	14.33	8.60	15.65	0.58
Median	10.08	22.84	26.04	14.58	8.48	15.58	0.81
Max	10.82	24.71	28.14	16.07	10.06	17.94	1.43
Min	8.80	20.96	23.27	10.65	7.30	13.22	-0.93
Std. Dev.	0.54	1.05	1.08	1.56	0.99	1.07	0.67
Sum	713.91	1638.1	1876.2	1031.7	619.53	1126.86	42.04
Obs.	72	72	72	72	72	72	72

ICT investment data from ITU (2009) has been collected from ITU. We have used the total annual investment in telecommunication in US dollar as a proxy for ICT investment. The measurement of human capital always encounters numerous empirical difficulties, therefore this study restricts the focus to human capital investment in form of education and ignores investment in health in a manner similar to Mankiw et al. (1992). Data on the school age population of the secondary and tertiary education used as a measure of investment in human capital which compiled from UNESCO Institute for statistics (UIS 2011). The data on FDI was compiled from the statistical resources published by the World Bank. The descriptive statistics of all variables used in the regression analysis are summarized in Table 1.

ESTIMATION METHOD

The following represents the panel data estimation equation used in this paper:

$$Y_{it} = \delta_i + \Gamma_t + (X_{it})\,\Phi + \psi_{it} \qquad (7)$$

where Y_{it} is GDP per capita (PPP) at constant 2005 prices in US dollars in country i at year t; X_{it} is a vector of the explanatory variables (investment in ICT, physical capital stock, human capital stock, trade openness and FDI) for country $i = 1, 2…, m$ and at time $t= 1, 2, …, T$; Φ is a scalar vector of parameters of $\beta_1, …, \beta_m$; ψ_{it} is a classical stochastic disturbance term with $E[\psi_{it}] = 0$ and $var[\psi_{it}] = \sigma_\varepsilon^2$, δ_i and Γ_t are country and time specific effects, respectively.

Since some of the explanatory factors of the traditional growth model are pre-determined, endogenous or both, the economic growth in the present period (t) depends upon its values in the past (t-1). Therefore a dynamic form of Equation (7) is utilised, known as the Arellano-Bond estimation (1991), which is specified as follows:

$$\Delta Y_{it} = \alpha' \Delta Y_{it} + \beta' \Delta X_{it-1} + \gamma' \Delta Z_{it} + v_i + \varepsilon_{it} \qquad (8)$$

where ΔY_{it} is first difference of GDP at constant 2005 prices in US dollars in country i during time t, ΔY_{it-1} is lagged difference of the dependent variable, ΔX_{it-1} is a vector of lagged level and differenced pre-determined and endogenous variables, Z_{it} is a vector of exogenous variables, and α, β, and γ are parameters to be estimated;

ε_{it}'s are assumed to be independent over all time periods in country i. The term v_i represents country specific effects, which are independently and identically distributed over the countries while ε_{it} is the stochastic disturbance term that also assumed to be independently distributed.

We can estimate the parameters by making use of the Arellano-Bond (1991) GMM estimator to evaluate the joint effects of ICT investment and other explanatory variables that are used in the economic growth model of NICs, while controlling for the potential bias due to the endogenous nature of some of the regressors.

FINDINGS AND DISCUSSION

The present research is based upon four Asian NIC countries during the period of 1990-2007, namely Singapore, Hong Kong, South Korea and Malaysia. Findings based on the Panel Least Squares method estimated for models A and B are summarized in Table 2.

Results indicate that ICT has a positive and statistically significant impact on GDP in model A. We

TABLE 2. Estimation Results using Panel Least Squares Method

Variables	Model A Coefficient	Model B Coefficient
Constant	4.68(6.79)***	1.99 (1.94)*
Ln(ICT)	0.39(3.66)***	0.03(0.87)
Ln(K)	0.12(1.78)*	-0.01(-0.50)
Ln(H)	0.07(1.50)	0.06(2.55)**
Ln(N)	-0.80(-6.14)***	0.80(4.86)***
Ln(FDI)	0.07(2.23)**	0.01(1.38)
Ln(OPEN)	-0.32(-4.40)***	0.41(5.22)***
Ds*Ln(ICT)	-	0.47(8.11)***
Dh*Ln(ICT)	-	-0.09(-3.11)***
Dk*Ln(ICT)	-	0.06(1.21)
Ds	-	-8.26(-6.79)***
Dh	-	3.85(6.17)***
Dk	-	-1.17(-0.85)
Adjusted R-squared	0.89	0.99
F-statistic	105***	889.81***

t-statistic in parentheses:
***,** and * denote statistically significant at 1%, 5% and 10%, respectively:
The dependent variable is Ln(GDP)

found that a 1% increase in the ICT investment of typical NICs resulted in a 0.39% increase in the GDP. Similarly, physical capital stock (K), human capital stock and FDI had positive and statistically significant impacts on the real GDP per capita of the sample NIC economies. On the other hand, in model B, human capital stock (H), labor (L), trade openness (OPEN) and the impact of ICT on GDP of Singapore are positive and significant.

The results based on the Panel Least Squares method, in which we simultaneously account for the heterogeneity and time fluctuations in the economic performance of NICs, confirm the hypothesis of the paper. However, it should be noted that some explanatory variables in our regression are either pre-determined (trade openness) or endogenous (FDI). For example, while FDI has often been appreciated for its role in the economic growth of a country, some studies (Hansen & Rand 2004; De Mello 1999) argue that the amount of FDI a country receives is influenced by the level of GDP and its growth rate. In this situation applying the Panel Least Squares technique may mislead the results.

Accordingly, we investigated the effect of ICT investment on economic growth in NICs by employing the GMM estimator developed by Arellano and Bond (1991), which addresses those problems more effectively and obtains robust estimates. In this method, lagged values of the explanatory variables are used as instruments and an over-identification test is applied to ensure there is no bias due to correlation with the error term.

Regarding the extensive data period, which covers 18 years, we do not anticipate a problem relating to stability in our results, a problem that Bond et al. (2001) and others were concerned with when the number of observations was small. Our estimated results from models A and B, based on the GMM for dynamic panel data, are summarized in Table 3. Broadly, the results confirm the expected relationship between the GDP, ICT investment and other variables.

Furthermore, the variables representing the sources of growth like ICT, physical and human capital have the expected positive signs. Since our estimated model was in logarithmic form, all the coefficients represent elasticities. In the context of GMM, the over-identifying restrictions may be tested via the commonly employed J-statistic of Hansen (1982). The J statistic is distributed as χ^2 with degrees of freedom equal to the number of over-identifying restrictions (L − K) where L is the number of instrumental variables and K is the number of explanatory variables.

J is the most common diagnostic test in GMM estimation to analyze the appropriateness of the model. A rejection of the null hypothesis shows that the instruments are not properly chosen. This may be either because they are not truly exogenous or, or because they are being incorrectly excluded from the regression (Baum et al. 2003). In this paper, the J-statistic rejects the null

TABLE 3. Estimation Results using the Dynamic Panel Method and (GMM Estimator)

Variables	Model A Coefficient	Model B Coefficient
Constant	3.43(5.22)***	6.51(2.88)***
Ln(ICT)	0.32(2.86)***	0.10(2.89)***
Ln(K)	0.20(2.24)**	0.04(0.48)
Ln(H)	0.13(2.60)***	0.03(2.76)***
Ln(N)	-0.63(-5.60)***	0.20(1.40)
Ln(FDI)	0.10(3.94)***	0.01(1.27)
Ln(OPEN)	-0.28(-4.62)***	0.14(1.95)*
Ds*Ln(ICT)	-	0.34(3.09)***
Dh*Ln(ICT)	-	-0.12(-3.40)***
Dk*Ln(ICT)	-	0.12(2.13)**
Ds	-	-6.09(-2.13)*
Dh	-	3.88(7.30)***
Dk	-	-2.54(-1.64)
Adjusted R-squared	0.96	0.99
F-statistic	22.90	9.04
Total panel Observations	68	68

t-statistic in parentheses:
***,** and * denote statistically significant at 1%, 5% and 10%, respectively:
The dependent variable is Ln(GDP)

hypothesis of correlation between residuals and instrumental variables. Therefore, the credibility of the results for interpretation is verified and the results can be interpreted with a high level of confidence.

The coefficient of ICT investment is positive and statistically significant at the 1% level in both models. Since all variables are in logarithm, the value of coefficients represents their elasticities. For example, the ICT coefficient of 0.32 indicates implies that a 1% increases in ICT investment would lead to a 0.32% economic growth in these countries. The statistics presented by the World Bank and other international organizations indicate an increasing trend of ICT usage in these countries, meaning that these countries recognized the important effect of ICT investment on their economic growth. In short, these results verify the meaningful and stable growth inducing effect of ICT investments in NICs. They also verify the hypothesis of this paper that ICT investment have a significant growth generating effect and support the studies performed by Kraemer and Dedrick (2001), Lee and Khatri (2003) and Pohjola (2001).

In addition, the different effect of ICT investment on the economic growth of the four NICs in Asia was demonstrated in model B. The ICT coefficients for Malaysia, Singapore, Hong Kong and Korea are 0.10, 0. 44, –0.02 and 0.22, respectively. This result indicates that the effect of ICT investment on GDP in Singapore is stronger than the others, while this effect is even negative for Hong Kong. It should also be noted that the impact of ICT on economic growth of these four countries are highly significant.

As these regression results show, the mean GDP per capita in Malaysia is about 6.51, that of Singapore is lower by about 6.09, that of Hong Kong is higher by about 3.88 and finally the mean GDP per capita of Korea is lower by about 2.54. As can be seen in Table 3, the estimated coefficient for Korea is not statistically significant. Therefore the actual mean GDP per capita of Malaysia and Korea are about the same and equal to 6.51. The mean GDP per capita of Singapore and Hong Kong are about 0.42 and 10.39, respectively.

On the other hand, based on the estimated results of model B, the capital stock (K) coefficient is 0.04 but not statistically significant. Moreover, human capital has positive and significant effects (0.03) on economic growth in these four countries, although effects are still weaker than that of ICT capital, with the exception of Hong Kong (0.03 vs. 0.10, 0.44 and 0.22). Levine and Renelt (1992), Barro (2001), and Sachs and Warner (2001) reached a different conclusion in this regard.

The FDI coefficient, as an indicator of the technical and technological indices of the model, is equal to 0.01, but not significant at even a 10% significance level. Capital deepening and technical growth are among the main factors of economic growth in any society, but the relatively low value of the estimated coefficient for the FDI variable for the period of 1990-2007 does not reflect this prediction.

The sign of labor input coefficient is positive but not significant. The trade openness coefficient is 0.14 and statistically significant at the 10% significance level, indicating the positive effect of this variable on economic growth. This result is important because NICs are distinguished from other developing countries for their high degree of trade openness. Finally, the main findings of this paper on the effect of ICT on economic growth are close to those of Nour (2002).

CONCLUSIONS AND IMPLICATIONS

This paper concentrated on exploring the supply side of ICT in four Asian NIC countries. The results of the growth model estimations with ICT investment as an explanatory variable using Panel Data method for the period 1990-2007 demonstrates that ICT has a significant effect on the economic growth of these countries. The coefficient measuring the effect of ICT investment on economic growth was positive, indicating that ICT investment affected the economic growth of the four NICs in a positive way. The FDI coefficient, which is the technical and technological index of the model, is positive but not significant. This shows that FDI growth does not have a powerful effect on the economic growth of NICs.

Consequently, ICT plays a vital role as a means for economic growth. Therefore, it seems necessary that Asian NICs encourage investment in ICT in order to boost economic growth. The last, but not least, NIC countries cannot get the full benefits from ICT unless they possess suitable infrastructures and skills required for utilizing ICT capabilities. Therefore is essential for the governments to provide society with information, up-to-date structures and education in order to use ICT efficiently. Since trade openness in the model has a positive and significant effect on economic growth, it is crucial for these countries to be more active in attracting international markets to their products and enjoying more ICT capital goods and services in the import sector.

In other words, policy makers should encourage free trade through decreasing tariffs and eliminating non-tariffs barriers to ICT imports, thereby facilitating economic growth through increasing the trade openness index of the country. To fill the gap that exists between NICs and leading countries in the field of ICT development, it is essential to allocate and ensure necessary financial resources for investing in network infrastructures and technology with the aim of providing new potentials in NIC countries.

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