



Is ICT a new essential for national economic growth in an information society?



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ABSTRACT

This paper attempts to empirically verify the theoretical assumption that ICT factors affect national economic development. To this end, this study will use a research model to examine the relationship between ICT and development through statistical evidence. IT infrastructure, IT competence, IT investment and IT trade size will be selected as variables reflecting ICT factors since these are widely used by the balance model of supply and demand. Also, this paper will employ several socio-economic factors such as population size, consumer inflation, national corruption and education as control variables. A panel data analysis was used to statistically verify the impact of national ICT capability on a country's development. Furthermore, this paper tried to find an intervening variable between ICT and national development such as national corruption, consumer inflation and national education that have been highlighted as important elements of national development from political and social perspectives, and improved explanatory power of the analysis model. This result indicates that these variables mediate ICT capacity's effects on each surveyed nation's economic growth. This study verified statistic relevance for the effects that ICT capacity has on economic development.

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1. Introduction

Many researchers highlight ICT's role in and impact on the progress of human history after the Industrial Revolution (Northrop, 2000). The ITU (2010) defines ICT as an efficiency parameter of technological advance that revolutionizes production, logistics process and decision making. The effects of the information revolution are reaching a whole range of daily activities, bringing changes in the role and scope that the government, business and individuals play (Jin, 2008).

A diversity of both optimistic and pessimistic views co-exists on the ICT-led paradigm shift in human history.¹ Thus this issue has been subject to intense controversies in academia since 2000. Certain papers made a negative pitch of the digital divide and internet abuse or misuse (Haywood, 1998; Loader, 1998; Perelman, 1998; Schiller, 1966; Wresch, 1996), whereas other papers shed a positive light on ICT-initiated national development and its subsequent improvement in quality of life (Kim, 2013; Kraemer & Dedrick, 2001; Naisbitt, 1982; Negroponte, 1995; Toffler, 1990).

In this regard, other economists have debated whether ICT is a new production value system that can drive national development. Under this circumstance, ICT has become a subject of discussion on how it influences an economy and attests to the need for empirical studies on the effectiveness of the IT revolution since the 1980s. Certain studies on this topic exist, but a more in-depth study is needed because ICT began to impact human history around 30 years ago. Studies have to go into further detail on ICT's effects on national economic development. And another consideration is the unique nature of national policies that includes social context in studying ICT's effect on national development (Lasswell, 1971).

In this vein, this paper attempts to assess the impact of ICT capacity on economic development. To this end, statistical and empirical verification of the ICT sector, which are considered important factors in economy, is performed. Also, a panel data analysis method (which can analyze both longitudinal and cross sectional effects at the same time) is used and examines the issue with time variable on the vertical axis.

2. Theoretical and literature reviews

2.1. Literature review

The literature review finds that two research methodologies are used in examining how ICT development affects national competitiveness and economic growth. One method is a longitudinal approach for time-series analysis. This method considers chronological time flow in

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¹ Theological arguments on the information society have been conducted by scholars with both positive (Negroponte, Naisbitt, Toffler, Wurman, Godfly) and negative (Schiller, Loader, Wresch, Perelman, Haywood) perspectives on the matter (Kim, 2013: 14–16).

examining how a variable is correlated to another. The other method is a cross-sectional approach that involves multiple countries; the major purpose of this method is to target multiple countries to find a cross-country analysis in which ICT progress affects national competitiveness or economic growth.

The typical method of the longitudinal approach is to choose one country as a case study to examine how ICT development is related to economic development over a particular time span. The analysis method used in this approach is usually statistical time series analysis or descriptive case study as illustrated by the following cases.

Cisco (2003) uses time series analysis to explain that investment in ICT has positively affected economic growth in the U.K. (1992–2000). The positive impact of ICT investment was found to be particularly evident on the job market, and was achieved through human capital restructuring. Similarly, Chu (2005) finds that profit generated by New Zealand's IT service sector positively correlated to GDP growth from 1987 to 2001.

The literature review finds that most previous papers use a single country as a case study. Therefore, these prior studies are considered to have a limitation on generalizing the findings to all nations. In this sense, this paper broadens horizons by surveying 128 countries to overcome the limitations of preceding papers, namely the time series study of one case.

The other method is a cross-sectional approach to find a relationship between ICT progress and national development. The major purpose of this approach is to generalize the relationship between these two variables. Therefore, the analysis studies a diversity of nations to examine how ICT development is related to national development. To conduct comparative studies on national ICT levels across countries, Northrop (2000) examines relationships between economic factors, social infrastructure and information infrastructure (Garson, 2000a, 2000b: 256–280). This study has shortcomings, however, in that its coverage is confined to computer penetration and lacks a comprehensive conceptual approach of ICT.² But the good point of this study is to use the path model, which uses multiple regression analysis and path analysis in studying factors that affect cross-country differences in computer penetration. The analysis result finds information infrastructure to have the biggest impact on each country's computer penetration, and GDP and social infrastructure have the largest effect on information infrastructure.

Many similar papers have mentioned how an economy can benefit from ICT progress. First, NIA (2011) suggests a positive impact of ICT on national competitiveness through a study on how cross-country ICT status is correlated to WEF's indicator on national competitiveness. Second, the OECD (2008) says in a study of 19 countries that broadband technology penetration is related to GDP growth. Finally, LaRosea and Bauer (2013) emphasize the importance of public investment based on an analysis of the broadband technology opportunities program.

But all of these studies have shortcomings in that the approach narrowly focuses on the relationship between GDP and IT infrastructure (e.g., penetration of broadband and IT hardware) without considering other socio-political factors that might interfere in the relationship between ICT investment and GDP development. Preceding studies have also lacked methodological stringency as they take a time-flat approach while ignoring the chronological time-lag effect. It is common to overlook the time-lag effect in conducting a policymaking purpose research. When a causal factor is brought into consideration, we must consider the time-lag effect since it takes time before an outcome is realized by the introduction of input factor.

Moshe (2010) and Parsons (1996) have already indicated the time order between the precedence and result factors in examining the

causal factor of economic development. But this principle has not been widely adopted due to the difficulty of the collection of time series data.

To overcome the limits of preceding papers, this paper utilized panel data that has been stored over a 13-year period, from 1999 through 2012, which measures various ICT and economy related indicators of 128 countries. Therefore, this paper has methodological strength compared to the precedent researches, which enables the consideration of both cross-sectional and time dimensions in examining the causal effect of ICT on nation's economic development.

2.2. Review of theory

2.2.1. National competitiveness and economic growth

The meaning of national competitiveness has been defined from multiple perspectives by various institutions. They include the ECD,³ EU (Competitiveness Advisory Group), USA (U.S. Competitiveness), U.K. (Competitiveness White Paper), IMD (The World Competitiveness Yearbook), WEF (The Global Competitiveness Report) and UNDP (Human Development Index).

In addition, many studies use it as a conceptual basis that involves an intrinsic concept of evolutionary direction. The following chart shows that each definition of national competitiveness draws out its respective set of measurement factors to be quantified and described. Although many controversies linger over measurement variables, GDP is used as a major variable that represents productivity in assessing a nation's competitiveness.⁴

Porter (1990: 543–573) explains the development process of national competitiveness by dividing the process into four stages. The core message from the development strategies of national competitiveness by Porter (1990) lies in a development process of societal cohesion achieved by undergoing four stages: factor-driven stage, investment-driven stage, innovation-driven stage and wealth-driven stage

Reflecting a similar position, other papers have made theoretical assertions that economic growth drives competitiveness because the former is seen as a core element of enhancing the latter.

Cicccone and Jarocinski (2009) have shown statistically verified factors that influence economic growth.⁵ This approach is a departure from the traditional model that focuses solely on economic factors to explain growth. In this model, economic growth is assumed to be a production function of labor, knowledge and technique.⁶ Thus Antonio and Marek's theory outlines disciplined labor, capital investment and technological progress to be the key drivers of economic growth (Hicks & Hollander, 1977; Kaldor, 1956; Pasinetti, 1977; Samuelson, 1978).

Meanwhile, an alternative economic growth theory includes socio-economic factors (e.g., regulation, corruption,⁷ education and ethics) as new factors to influence growth ($Y = F(L,K,T,S)$). In this alternative model, "S" is offered as a socio-economic factor and the need is stressed to add non-economic factors like socio-economic variables onto the traditional model's economic factors to better explain economic growth (Jalilian, Kirkpatrick, & Parker, 2007: 1–5; Nicoletti & Scarpetta, 2003). In this model, corruption is singled out as a major obstacle to economic

³ They define it in long-term perspective as that each country's level of increasing their people's real income by making it possible to produce goods & services as required by the world under free and fair market conditions.

⁴ Economic growth factor is the most important gauge of national competitiveness. Besides this, national competence is also stressed as another important factor that leads mental, institutional and technological communication and convergence. To explain it, national corruption, education, and price increase are used in common as measurement variables by OECD, EU, UK, IMD, WEF and UNDP.

⁵ In the research, they identified the key elements of economic growth as education, population growth, natural resources, government size, openness to trade, market access, inflation, age structure, war and conflict, and economy size.

⁶ $Y = F(L,K,T)$.

⁷ Klitgaard (1998) defines corruption as "deviation from official duty or violation of rules to gain monetary and status income". Transparency International (TI) defines corruption as the "abuse of entrusted power for private gain."

² Huntington (1996) considers computer ownership as the most important factor for modernizing a country. Northrop (2000) gets an idea from Huntington and conducts research whose coverage is limited to the number of computers owned.

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