



Development of telecommunication and broadcasting infrastructure indices at the global level

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ABSTRACT

The importance of information and communication technology (ICT) in economic development has been increasing rapidly along with the Internet and mobile telecommunication networks. ICT development is becoming a main growth factor of many countries. As they realize the importance of the ICT industry, developing nations work to catch up with established economies. Therefore, many nations are formulating an ICT-enhanced policy. This paper introduces a number of telecommunication and broadcasting sub-indices, which include the fixed telephone network, the Internet, and mobile networks, which are aggregated into a composite Telecommunication Index (TI). The indices are computed using principal component analysis and human development type index methods. The country rankings, by different ICT-related indices, help identify the strengths and weaknesses of infrastructure development such that each country can foster economic growth. The performance of TI is compared with several other indices, such as the digital access, human development, and ArCo technology indices. The type of indices affects the country ratings. Results suggest that the parametric index approach may be preferred over those methods in which the subjective weighted summation of normalized variables used (non-parametric indices).

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1. Introduction

For the last decade, information and communications technology (ICT) has played a major role in national and international economic growth. Therefore, ICT development has become one of the main economic growth factors for national economies. Developed countries exhibit higher ICT investment than do the developing countries. However, most developing countries have recently realized the importance of ICT investment, such as for building related infrastructures, maintaining national databases, and enhancing ICT policies. By uncovering evidence of the positive effects on economic growth, many researchers and economists have spurred the movement toward ICT investment. The literature has been growing since the 1990s.

Most economists, researchers, and policy makers now agree on the importance of ICT as a major contributor in domestic and global economic development. Therefore, information on the ICT position of any country provides helpful data for initiating a successful national policy focused on ICT development. It will especially benefit developing countries as they seek the keys to the success that led to ICT development in leading economies.

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Many researchers have compared economic performance across countries in terms of indices, such as the Human Development Index (HDI) (see Archiburgi & Coco, 2005). However, the cited indices do not rank countries solely by data on ICT-related infrastructure.

Moreover, the increased significance of telecommunication and broadcasting service convergence, such as that involving Internet Protocol TV (IPTV), Voice over Internet Protocol, WiMax, and Internet Protocol (IP) telephony, represents a profound reshaping of the industry. As those services depend on the telecommunication and broadcasting infrastructures, the level and the size of national investment into the underpinnings of these technologies is expected to greatly impact the economy.

Use of sub-indices and a composite infrastructure index could help countries evaluate their potential for better economic performance. Also nations will benefit from information on the isolated effects of telecommunication and broadcasting infrastructures on economic development and growth.

In this study, telecommunication and broadcasting infrastructures are categorized into four main dimensions: the fixed telephone network (FTN), Internet, mobile, and broadcasting. It is argued that ranking countries based on these dimensions (a) shows the global position of each country with regard to ICT infrastructure and (b) pinpoints the sources of failure in developing ICT infrastructure.

The sub-index rankings could help governments rationally develop policies and regulations through sector-specific targeting and by accounting for their position in relation to other countries. Moreover, through use of a weighted summation of normalized variables similar to that used by the United Nations Development Programme and other researchers (see Archiburgi & Coco, 2005; HDI), a composite Telecommunications Index (TI) for countries with available ranks in FTN, Internet, and mobile was calculated to show the overall global position of each country.

Contributions to the literature can be summarized into two main areas. First, using as many relevant variables as possible, three telecommunication sub-indices were computed parametrically using principal component analysis (PCA). Secondly, using a non-parametric approach (weighted summation of normalized variables), a composite communications index was computed. Finally, using the PCA approach, a broadcasting index was also calculated.

The paper is organized as follows. First, a review of previous research studies regarding ICT definition, indices, and categories is provided in Section 2. A summary of the two main factor analysis approaches, common factor analysis (CFA) and PCA, is offered in Section 3. Data descriptions and empirical results are given in Sections 4 and 5, respectively. Following Section 6, guidelines for constructing better indices, Section 7 features the conclusion and suggestions for further research studies.

2. Literature review

Based on ISIC (Rev. 3 of 1998),¹ the OECD divided an industry-based ICT definition into two categories: manufacturing and services.² Those considered an ICT product in manufacturing industries function for “information processing and communication” and entail “electronic processing to measure and/or record physical phenomena or control a physical process.” Those in the services sector enable “the function of information processing and communication by electronic means.” A country needs an ICT infrastructure as a backbone for all ICT manufacturing and services. Telecommunication infrastructures, including those for the Internet, mobile, FTN, and broadcasting, provide the main physical bases for ICT services.

The relationship between ICT and economic growth has been intensively investigated and analyzed by many authors in the last decade. Some have argued that there is empirical evidence of a positive correlation between these two factors. Jalava and Pohjola (2002) showed that the use of ICT and the quality of production have been the main factors behind US economic performance in the 1990s. In the case of Finland, they found that the ICT contribution to productivity boosted growth from 0.3% to 0.7% between the early and late 1990s. Bakhshi and Larsen (2005) argued that, in the long run, ICT investment is the source for approximately 20–30% of labor productivity growth in the UK. They showed that an increase in return on ICT investment will raise the depreciation rate and expenditures, respectively. Analyzing the effect of implementing e-business applications in EU firms productivity, Falk (2005) found a positive correlation between “labor productivity growth and the percentage of enterprises with new or significantly changed organizational structures.”

Despite the significant number of researches, there is still a shortage in evidence of the ICT contribution to the economic growth in the developing countries. For instance, a recent study showed that the significance of ICT contribution to economic growth is only “in many developed countries and Newly Industrialized Economies (NIEs), but not in developing countries” (Lee, Gholami, & Tong, 2005). Similarly, Roller and Waverman (2001) found that telecommunication infrastructure contributes a great deal to the economic growth in countries with a critical mass of telecommunication infrastructures. In the paper regarding “the Swedish ICT miracle,” Edquist (2005) concluded that “[a] miracle took place in the ICT producing manufacturing industries and not in the ICT using industries.” Moreover, the author showed that the growth of the radio, television, and communication industries has been affected by value-added price deflators. Therefore,

¹ Revision 3 of the International Standard Industrial Classification.

² See OECD Science, Technology and Industry Scoreboard 2005—towards a knowledge-based economy <http://hermia.sourceoecd.org/vl=2171243/cl=45/nw=1/rpsv/scoreboard/d14.htm>.

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