

The Role of Information and Communication Technology in Transport Industry Development

by Wilson Rajagukguk

Submission date: 18-Apr-2023 08:35AM (UTC+0700)

Submission ID: 2067829960

File name: ionandcommunicationtechnologyintransportindusteridevelopment.pdf (922.7K)

Word count: 3016

Character count: 16839

PAPER · OPEN ACCESS

The Role of Information and Communication Technology in Transport Industry Development

To cite this article: Wilson Rajagukguk 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **918** 012064

View the [article online](#) for updates and enhancements.

You may also like

- [An analysis on the environmental Kuznets curve of Chengdu](#)
Zijian Gao, Yue Peng and Yue Zhao
- [Relationship of population migration, crop production pattern, and socioeconomic development: evidence from the early 21st century](#)
Yajie Zhang, Jie Zhao, Yuxing Yan et al.
- [The correlated factors of the uneven performances of the CDM host countries](#)
Jinshan Zhu



ECS The Electrochemical Society
Advancing solid state & electrochemical science & technology

242nd ECS Meeting

Oct 9 – 13, 2022 • Atlanta, GA, US

Early hotel & registration pricing ends September 12

Presenting more than 2,400 technical abstracts in 50 symposia

The meeting for industry & researchers in

BATTERIES
ENERGY TECHNOLOGY
SENSORS AND MORE!

 Register now!

 **ECS Plenary Lecture featuring M. Stanley Whittingham,**
Binghamton University
Nobel Laureate –
2019 Nobel Prize in Chemistry



The Role of Information and Communication Technology in Transport Industry Development

Wilson Rajagukguk¹

¹Universitas Kristen Indonesia, Faculty of Economics and Business, 13630 Jakarta, Indonesia

E-mail: wrajagukguk@yahoo.com

Abstract. Information and communication technology (ICT) has been a part of global life and also has a positive impact on human welfare. ICT involves activity, hardware, and electronic software that execute processing, transmission, and displaying information. This study aims to investigate the impacts of ICT on economic welfare. The data used were from the World Development Indicators of the World Bank for 82 countries during 2009 through 2017. The dependent variable was GDP per capita and the independent variables were ICT indicators, measured by the number of automated teller machines (ATMs), fixed broadband subscriptions, and mobile cellular subscriptions. The data were analyzed employing a random effects regression model for panel data. The results of study indicate that the number of ATMs, fixed broadband subscriptions, and mobile cellular subscriptions had significant effects on GDP per capita statistically. Higher economic welfare was associated with higher number of ATMs, fixed broadband subscriptions, and mobile cellular subscriptions.

1. Introduction

The World Bank defined information and communication technology (ICT) as a set of activities facilitated by electronic equipment in processing, transmission, and presenting information [1]. ICT refers to technology used by people to share, distribute, and collect information and communicate through computer and computer network [2]. UNESCO defined ICT as technology form that is used to transmit, save, create, share, and exchange information [3]. Technology in this case includes radio, television, video, DVD, fixed line and mobile phone, satellite system, computer, hardware and software network, and equipment and services associated with technology, such as video conference and electronic mail. ICT is a combination of communication, reservation, processing, and multimedia capability [4]. The main role of ICT is done through communication network that later named ICT. In Covid-19 pandemic today, almost all people's life aspects use ICT to facilitate people to continue working and studying from home.

Today we live in information and communication era. Information and communication technology has an important role in this world. With ICT, companies can do business with clients, suppliers, and distributors more easily. ICT has become very important in people's daily lives. People read online newspaper. Someone can connect with his/her family and colleagues even when being abroad through electronic mail, call conference, or video conference.

Digital computer and network has changed world's economic concept to no boundary economics in time and space. ICT brings a number of advantages to economic development because it enables

million transactions occurred quickly and easily. ICT also has become pillars to achieve national competitive advantage. ICT can improve human life quality because it can be used as learning and education media and mass communication media in important and practical issue promotion and campaign, such as health and social areas. ICT gives broader knowledge and can help in finding and accessing information.

ICT has become the first rate in education system. Scientific finding, in particular training science, developmental psychology, knowledge, and education capability have improved markedly because of ICT [4]. ICT also can reduce education system gaps as well as encouraged and improve creativity, critical thinking, and learning how to learn, curriculum development, and learning implementation.

ICT trade contributed to the economy. As it can be seen from Figure 1, during 2000–2018, the share of ICT trade in the world was between 10.2%–16.0%, in Africa was between 0.6%–1.4%, in America was between 6.9%–15.4%, in Europe was between 4.2–10.4%, and in Asia and Oceania was between 17.4%–24.7% [5]. This indicates that world ICT trade, in particular in Asia and Oceania, gave an important share to the economy.

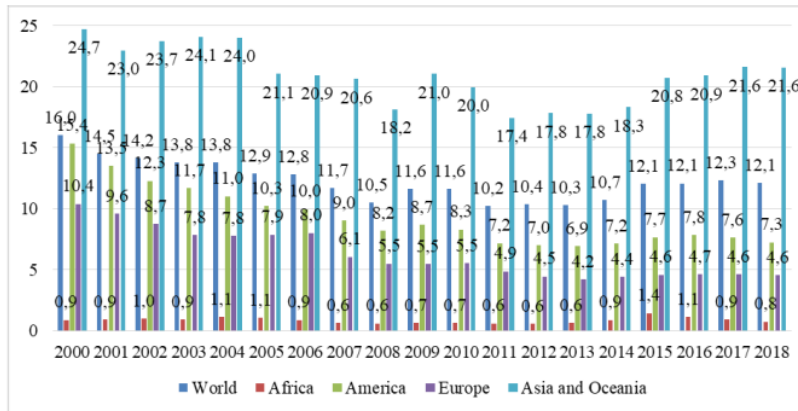


Figure 1. ICT trade share (%): World, Africa, America, Europe, and Asia and Oceania, 2000–2018.

This study aims to examine the role of ICT in economic welfare. ICT was measured by the number of automatic teller machines (ATMs), fixed broadband subscriptions, and mobile cellular subscriptions. Meanwhile, the indicator of economic welfare was GDP per capita.

The paper consists of five sections. The background and objectives of the study is presented in this section. In section 2, the literatures relevant to this study are reviewed. The data and methodology used in this study are discussed in Section 3. The results of empirical analysis are presented and discussed in section 4. The paper is closed with conclusions and policy implications presented in section 5.

2 Literature review

A number of studies have been conducted to examine the role of ICT in various aspects of life. Samosir, Kiting, and Aninditya [6] investigated the role of ICT in contraceptive discontinuation in Indonesia. They used the results of the 2017 Indonesian Demographic and Health Survey and employed contraceptive monthly calendar data and a Gompertz proportional hazards model in the data analysis. They found that higher contraceptive discontinuation was associated with ICT, measured by access to the Internet and ownership of a mobile phone. Women who had access to the Internet and had a mobile phone had higher odds of discontinuing contraception. They argued that women who had access to the Internet and had a mobile phone had higher access to the information and communication including those related to safe contraceptive discontinuation and its management.

Meanwhile, Dahlan [7] studied the nature and impact of ICT on business world and society. The study focused on the utilization of information system in all types of organizations, including manufacturing, services, public sector, and non-profit organization in the USA, Europe, Japan, and new industrial countries in the Pacific Rim. ICT became an invaluable resource in helping work and life of human in organization or society as a whole. ICT infrastructure, together with other macroeconomics, is an engine of economic growth in European Union countries [8].

Purnama and Mitomo [9] carried out a study on the impact of ICT on economic growth in 34 provinces in Indonesia. They found that the use of cellular telephone had a positive impact on economic growth in particular in provinces with lower income per capita. Provinces with higher economic growth also benefitted from higher education level. Also, provinces with lower economic growth experience had higher income per capita growth.

ICT can be measured by the number of automatic teller machines (ATMs), fixed broadband subscriptions, and mobile cellular subscriptions. Some studies have shown that the number ATMs of contributed to GDP and also employment opportunity. The number of ATMs had positive impacts on GDP in North America and Europe, including direct, indirect, and induced effects [10]. Williams et al. [11] also found the number of ATMs had positive effects on GDP and poverty reduction in developing countries.

A study by Czernich et al. [12] in OECD countries found that increase in broadband penetration raised annual per capita growth. The same result was also found by Mingos [13] in his study in a number of countries in the world. An increase of broadband penetration had an impact on the increase of GDP in China, Germany, United States, Ecuador, Panama, the Philippines, and Senegal.

Waverman et al. [14] carried out a study on the role of telecommunication investment in economic growth in developing countries. They found that investment in telecommunication boosted up economic growth dividend. It was because telecommunication can reduce interaction costs, enlarge market boundaries, and immensely increase flows of information.

Based on the above discussion, in this study it was hypothesized that the number of ATMs, fixed broadband subscriptions, and mobile cellular subscriptions influence economic welfare positively. More ATMs, fixed broadband subscriptions, and mobile cellular subscriptions will lead to more productive economy and hence higher economic welfare.

3 Data and methods

3.1 Data

This study used data from the World Development Indicators of the World Bank. The data covered 82 countries during 2009 through 2017 [15]. Therefore, there were 738 observations in the analysis. The dependent variable was gross domestic product (GDP) per capita (PPP constant 2011 international \$). Meanwhile, the independent variables were information and communication (ICT) indicators, measured by the number of automated teller machines (ATMs) per 100,000 adults, fixed broadband subscriptions per 100 people, and mobile cellular subscriptions per 100 people.

The World Bank defined GDP as gross domestic product converted to international dollars using purchasing power parity at 2011 constant price in international dollars (World Bank, 2020). Meanwhile, the ATM is the computerized telecommunications device of a financial institution that provides clients with access to financial transactions in a public place. Further, the fixed broadband subscription indicates the fixed subscriptions to high-speed access to the public Internet. It does not include subscriptions that have access to data communications (including the Internet) through mobile-cellular systems and comprises fixed WiMAX and any other fixed wireless technologies and both business and organization subscriptions. Furthermore, mobile cellular telephone subscription is subscriptions to a public mobile telephone service that provide access to the PSTN using cellular technology.

3.2 Methods

Stata version 15 was employed to analyze the data in this study. Univariate analysis was done to assess the summary statistics (number of observations, mean, standard deviation, and minimum and

maximum value) of GDP and number of ATMs, fixed broadband subscriptions, and mobile cellular subscriptions. Bivariate analyses were conducted to evaluate the relationship between the number of ATMs, fixed broadband subscriptions, and mobile cellular subscriptions and GDP before controlling for the effects of other factors. Inferential analysis of the impact of the number of ATMs, fixed broadband subscriptions, and mobile cellular subscriptions on GDP was performed using random effects regression model for panel data.

Results and discussion

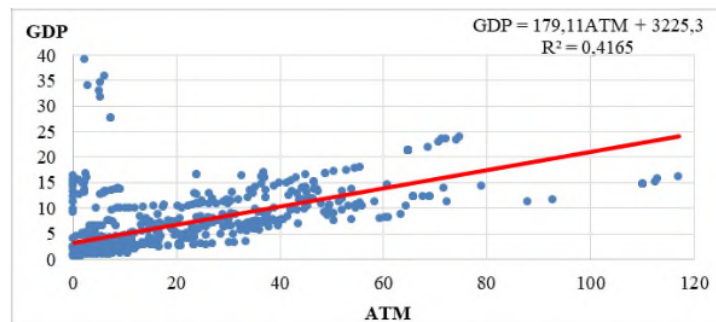
Summary statistics of variables in the model are presented in Table 1. These include number of observations, mean, standard deviation, minimum, and maximum value. It can be seen that GDP per capita ranged largely from a low of 637 international \$ to a high of 39,061 international \$. Meanwhile, the number of ATMs per 100,000 adults varied between none (0) and 117, number of fixed broadband subscriptions per 100 people differed from none (0) and 30.4, and number of mobile cellular subscriptions per 100 people ranged from a low of 4.75 to a high of 181.

Table 1. Summary statistics of variables in the model: number of observations, mean, standard deviation, minimum, and maximum value of 82 countries 2009–2017.

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
GDP per capita, PPP (constant 2011 international \$)	738	6,691.538	6,167.15	636.88	39,060.91
Automated teller machines (ATMs) (per 100,000 adults)	738	19.35	22.22	0.00	116.99
Fixed broadband subscriptions (per 100 people)	738	2.82	4.55	0.00	30.40
Mobile cellular subscriptions (per 100 people)	738	85.34	37.29	4.75	181.33

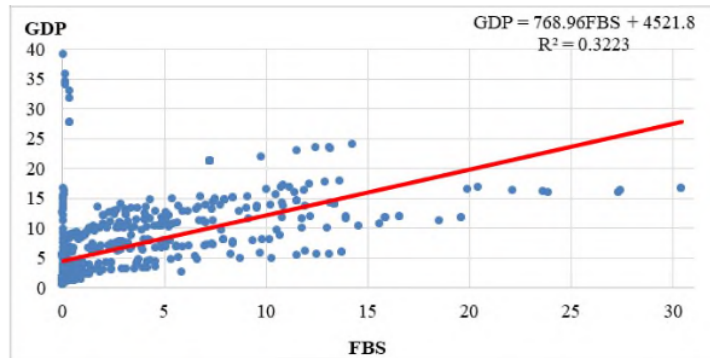
Source: World Bank [15] (Author's compilation).

The results of bivariate analyses utilizing scatter diagrams are displayed in Figure 2 – Figure 4. It can be seen that there is a strong positive relationship between the number of ATMs per 100,000 adults, fixed broadband subscriptions per 100 people, and mobile cellular subscriptions per 100 people and GDP. It means the higher the number of ATMs per 100,000 adults, fixed broadband subscriptions per 100 people, and mobile cellular subscriptions per 100 people, the higher GDP. An increase of one ATM per 100,000 adults, one fixed broadband subscription per 100 people, and one mobile cellular subscription per 100 people will lead to an increase of GDP per capita by, respectively, 179, 769, and 90 international \$.



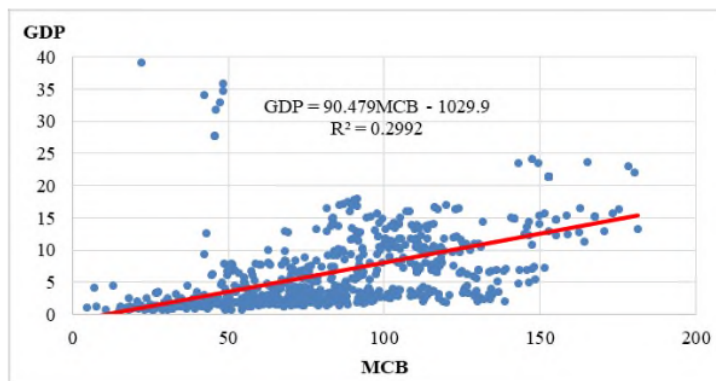
Source: World Bank [15] (Author's compilation).

Figure 2. Automated teller machines (ATMs) (per 100,000 adults) and GDP per capita, PPP (constant 2011 international \$): 82 countries 2009–2017



Source: World Bank [15] (Author's compilation).

Figure 3. Fixed broadband subscriptions (per 100 people) (FBS) and GDP per capita, PPP (constant 2011 international \$), 82 countries, 2009–2017



Source: World Bank [15] (Author's compilation).

Figure 4. Mobile cellular subscriptions (per 100 people) (MCB) and GDP per capita, PPP (constant 2011 international \$), 82 countries, 2009–2017

The results of random effects regression model for panel data of the effects of ICT on economic welfare are presented in Table 2. It can be seen that all ICT indicators examined in the study, that are the number of ATMs, fixed broadband subscriptions, and mobile cellular subscriptions, were significantly associated with GDP per capita statistically.

The effect of number of ATMs on economic welfare was statistically significant at the less than 0.001 significance level. After controlling for other factors, an increase of one ATM per 100,000 adults was associated with an increase in GDP per capita by 149 international \$. In this study, the number of ATMs was the strongest factor that influenced economic welfare. This finding supports previous studies by Rivas [10] and Williams et al. [11] that the number of ATMs can increase financial productivity and consequently economic welfare.

The effect of number of mobile cellular subscriptions was also statistically significant at the less than 0.001 significance level. Other things being the same, an increase of one in mobile cellular subscription per 100 people will lead to an increase of 18.6 international \$ in GDP per capita. In this study, the number of mobile cellular subscriptions was the second strongest factor that influenced

economic welfare. This finding supports previous studies by Czernich et al. [12] and Minges [13] that the number of mobile cellular subscriptions can enhance commercial output and hence economic welfare.

The effect of number of fixed broadband subscriptions was statistically significant too at the less than 0.001 significance level. Ceteris paribus, an increase of one in fixed broadband subscription per 100 people will lead to an increase of 153 international \$ in GDP per capita. In this study, the number of fixed broadband subscriptions was the third strongest factor that influenced economic welfare. This finding supports previous study by Waverman et al. [14, 15] the number of fixed broadband subscriptions can expand money-making activities and thus economic welfare [16].

Table 2. Coefficients, Standard Error, test statistic *t* statistic, and *p*-value for the fixed effects regression model of factors influencing GDP per capita, PPP (constant 2011 international \$)

Variables	Coefficients	Standard error	<i>t</i> statistic	<i>p</i> -value
Constant	1,786.54	525.47	3.40	0.001
Automated teller machines (ATMs) (per 100,000 adults)	149.10	7.54	19.78	<0.001
Fixed broadband subscriptions (per 100 people)	152.99	35.75	4.28	<0.001
Mobile cellular subscriptions (per 100 people)	18.61	2.87	6.49	<0.001

Source: World Bank [15] (Author's compilation).

5 Conclusions and policy implications

The results of the study clearly show that ICT had strong positive impacts on economic welfare [17,18]. The present of ATM, fixed broadband, and mobile cellular in a country will undoubtedly improve economic welfare of a country as these three ICT facilities can enhance economic productivity in a country. The presence of ATMs can improve financial performance. Meanwhile, the presence of fixed broadband and mobile cellular can boost economic activities. Therefore, it is important for countries to enhance its ICT in order to improve its economic welfare.

References

- [1] Rodriguez F, Wilson E, WB (2000)
- [2] Economic and Social Commission for Asia and the Pacific (ESCAP) 2001 : http://www.unescap.org/wid/04widresources/11widactivities/01ictegm/backgroundpa_per.pdf
- [3] United Nations Educational, Scientific and Cultural Organization (UNESCO) 2006 : www.unescobkk.org/education/ict
- [4] Shahmir S et al. 2010 *Procedia Computer Science* **3**
- [5] UNCTAD 2020
- [6] Samosir O., Kiting A, Aninditya F 2020 *J Prev Med Public Health* **53**
- [7] Ushakov D 2016 *Int.J. Of Environmental & Science Education* **11(18)**pp 12937-12945
- [8] Toader E et al 2018 *Sustainability* **10**
- [9] Purnama Y, Mitomo H 2018 *International Telecommunications Society*
- [10] Rivas V 2015 *Economics and Econometrics Society* **58**
- [11] Williams H et al 2017 *IJRESS* **7**
- [12] Czernich N, Falck O, Kretschmer T, Woessmann L. 2011 *Econ.J* **7**
- [13] Minges M 2016 *World Development Report*
- [14] Waverman L, Meschi M, Fuss M 2005 The Vodafone policy paper series
- [15] World Bank 2020 : <https://databank.worldbank.org/source/world-development-indicators>
- [16] Ushakov D et al. 2016 *Actual Problem of Economics* **2(176)**pp 80-88
- [17] Ushakov D, Vinichenko M, Frolova E. 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **272** 032111
- [18] Rungsisawat S 2018 *The EURASEANs: Journal on Global Socio-Economic Dynamics* **1(8)** pp 40-47.

The Role of Information and Communication Technology in Transport Industry Development

ORIGINALITY REPORT

14%

SIMILARITY INDEX

14%

INTERNET SOURCES

10%

PUBLICATIONS

2%

STUDENT PAPERS

PRIMARY SOURCES

1

www.ieomsociety.org

Internet Source

8%

2

www.e3s-conferences.org

Internet Source

3%

3

www.theglobaleconomy.com

Internet Source

3%

Exclude quotes On

Exclude matches < 2%

Exclude bibliography On