The impacts of final demand changes on total output of Indonesian ICT sectors: An analysis using input-output approach

Ubaidillah Zuhdi

Department of Industrial Administration, Tokyo University of Science, Noda 278-8510, Japan
School of Business and Management, Institut Teknologi Bandung, Bandung 40132, Indonesia

ubaidillah.zuhdi@gmail.com

Abstract. The purpose of this study is to analyze the impacts of final demand changes on total output of Indonesian Information and Communication Technology (ICT) sectors. This study employs Input-Output (IO) analysis as a tool of analysis. More specifically, demand-pull IO quantity model is applied in order to achieve the objective. "Whole sector change" and "pure change" conditions are considered in this study. The results of calculation show that, in both conditions, the biggest positive impact to the total output of the sectors is given by the change of households consumption while the change of import has a negative impact. One of the recommendations suggested from this study is to construct import restriction policy for ICT products.

1. Introduction

Technology is undoubtedly a tool used almost every day by people. For example, we can see that people use transportation devices, such as car, motorcycle and train, when they are going to somewhere. Moreover, people also use technology when they do their hobbies, such as photography, traveling, and game. Such examples affirm that, in recent days, technology could not be separated from daily life of society.

The importance of technology is also mentioned by researchers. [1] argued that now technology impacts, and impacted by, nearly every aspect of human life. [2] explained that technology is one of the major factors that dictate the history path and society form. [3] mentioned that green technology will have an important role in generating the power as countries search to reduce the dependence on the fuels which are imported, reinforce their independence on energy, and decrease the use of fuels that cause pollution.

One of the technologies frequently used by people is an Information and Communication Technology (ICT). The use of ICT can be easily observed in recent years. For instance, we can easily see people use mobile phone as well as fixed one when they communicate with others. The similar phenomenon can be seen on the use of internet. Nearly every aspect of society now needs internet. In other words, internet has become a powerful tool both in micro and macro activities. [4] affirmed this phenomenon, namely millions of people consume their hours each day for accessing and making information online.

There are many previous studies discussed about ICT. [5] explored the effect of ICT investments on development of human. More specifically, they investigated the correlations between different dimensions of ICT investment and the aspects of human development. Their objects of study consisted of 51 countries which were divided to three groups, namely high, middle, and low income countries. [6] developed the definitions and applications hierarchies for the term of ICT. [7] assessed the role of ICTs in enhancing access to agricultural information which was needed to develop the agribusiness and agricultural production. Their study focused on Tanzania.

[8] examined the correlation of investments in ICT and growth of economy in the geographical configuration using Generalize Method of Moments (GMM). Their study focused on OPEC member

countries. The period of analysis of their study was from 1990-2007. [9] investigated the role of ICT sectors in Indonesian national economic structural changes using Structural Decomposition Analysis (SDA), one of the analysis tools in Input-Output (IO) analysis. Their analysis period was from 1990-2005. [10] explored how to encourage ICT sectors of Indonesia using IO approach.

On the other hand, [11] compared the role of ICT sectors in the national economic structural changes of Japan and Indonesia using SDA. [12] employed two methods, SDA and simple output multipliers, in analyzing the role of ICT sectors in Japanese national economy from 1995-2005. He compared the results of calculation using these methods in order to get another perspective related to this role. The study discusses the impacts of changes of final demand, one of the variables in economy, on total output of ICT sectors of specific country, however, is still thin. The kind of study is important because it can describe more detail the characteristics of these sectors. Further, this description can be used to inquire the ways in improving the sectors. This study is conducted to fulfill this gap.

The purpose of this study is to analyze the impacts of changes of final demand on total output of ICT sectors of particular country. Analysis in this study focuses on Indonesia. In order to achieve the objective, this study employs IO analysis. This paper is arranged as follows. Chapter 2 explains the literature related to method which is used in this study. The methodology of this study is discussed in chapter 3. Chapter 4 explores the results of calculation and analysis of these results. Chapter 5 describes the conclusions of and further researches suggested from this study.

2. Literature review
The following description is fundamental information in IO analysis which is described by [13]:

"T*he fundamental information used in IO analysis concerns the flows of products from each industrial sector, considered as a producer, to each of the sectors, itself and others, considered as consumers. The basic information from which an IO model is developed is contained in an interindustry transactions table.*"

[14] explained that IO analysis is an economic tool that determines the connections between industrial sectors in the economy. They also mentioned that IO tables describe the inputs of commodity that are employed by each industrial sector to generate its output, the commodities made by each industrial sector, and the utilization of commodities by final consumers.

Demand-pull IO quantity model is one of the analysis tools in IO analysis. [13] argued that, in this model, the change appears on the quantity of commodities while the prices are fixed. Final demand acts as an exogenous variable while this model is applied.

3. Methodology
As described in introduction, the purpose of this study is to analyze the impacts of final demand changes on total output of Indonesian ICT sectors. IO analysis is employed in this study. More specifically, demand-pull IO quantity model is applied to achieve the objective. Following explanation describes the methodology of this study.

The first step is to define the data of this study. Adjusted and aggregated IO table of Indonesia for 2005 is used as data. The second step is to describe the ICT sectors used in this study. Table 1 shows these sectors. The next step is to conduct the calculation in order to know the impacts of modifications of final demand on total output of Indonesian ICT sectors. Demand-pull IO quantity model is applied in this calculation. According to [13], following equation describes this model:

$$\mathbf{x}^1 = \mathbf{L}^0\mathbf{f}^1 \tag{1}$$

where *x*, *L*, and *f* are matrices of total output of sectors, Leontief inverse, and final demand of sectors, respectively. *0* and *1* indicate initial and future times, respectively. Initial period in this calculation is 2005. The scenarios of final demand modification used in this study are described in table 2.

Table 1. ICT sectors of Indonesia used in this study.

No.	Sector Number	Sector Name
1	135	Construction and installation on electricity, gas, water supply, and communication
2	146	Communication services

(Source: [11])

Table 2. The scenarios of final demand modification used in this study.

Component of final demand	Scenario		
	1	2	3
	Export modification	Import modification	Households consumption modification
Export	Increases 30%	Constant	Constant
Import	Constant	Increases 30%	Constant
Households consumption	Constant	Constant	Increases 30%

(Source: [15] with slight modifications)

"Whole sector change" and "pure change" conditions are considered in the calculation. Former word explains the condition which modifications of final demand are addressed to all Indonesian industrial sectors while latter one only focuses on ICT sectors of Indonesia. In this study, former one will be called condition A while condition B is used in describing latter condition. Recommendations are suggested based on the calculation results. Conclusions of this study and suggestions related to the further research are described on final step.

4. Results and analysis

Figures 1 and 2 describe the total output of Indonesian ICT sectors for each scenario on condition A. X_t denotes total output of these sectors on initial period while total output on future period are explained by X_{t+1}. Based on information in these figures, in this condition, scenario 3, the change of households consumption, has the biggest positive impact to the total output of both Indonesian ICT sectors. On the other hand, scenario 2, the modification of import, gives negative impact to the total output of these sectors.

Figures 3 and 4 show the total output of Indonesian ICT sectors for each scenario on condition B. As with the previous explanation, X_t explains the total output of these sectors on initial period while X_{t+1} describes the total output on future period. These figures show that, in this condition, scenario 3, households consumption modification, has the biggest positive impact to the total output of both Indonesian ICT sectors. Contrarily, scenario 2, the change of import, generates the negative impact to the total output of these sectors.

Based on previous explanations, several similarities appear on both conditions. These are 1) the biggest positive impact to the total output of Indonesian ICT sectors is delivered by scenario 3, the change of households consumption, and 2) scenario 2, the change of import, gives the negative impact. These characteristics will be used as a foothold in suggesting the recommendations for above sectors.

[10] described the suggestions in improving ICT sectors of Indonesia, namely 1) to implement broadband internet service especially on the dense area, 2) to improve the mobile telecommunication access quality, 3) to improve the national postal service, 4) to improve the broadcasting services, and 5) to improve the activities related to the ICT commodities export. These actions focus on the improvements of ICT sectors so the demand from households and activities of export of these sectors is expected to increase.
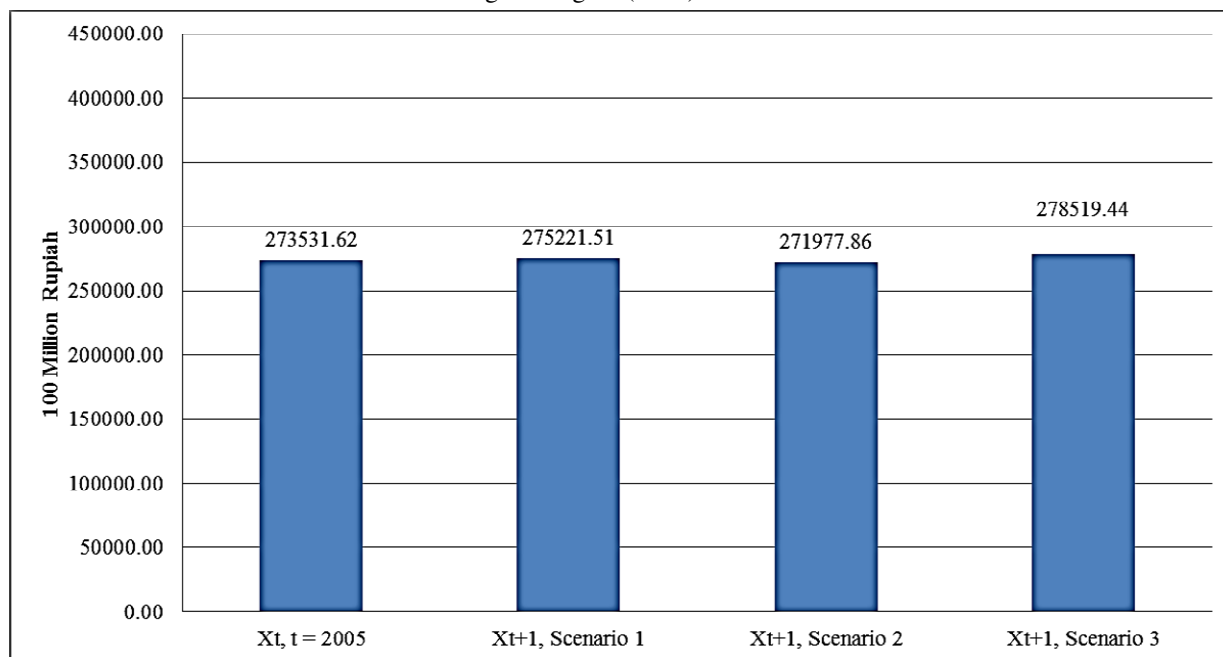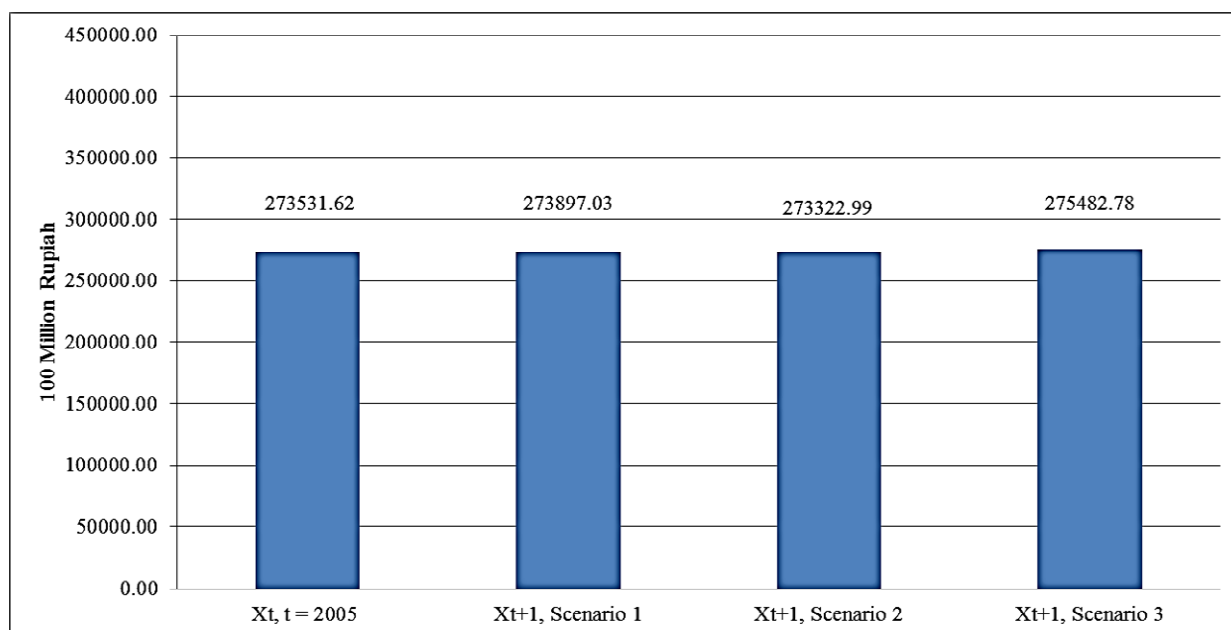
Figure 1. Total output of construction and installation on electricity, gas, water supply, and communication sector for each scenario on condition A

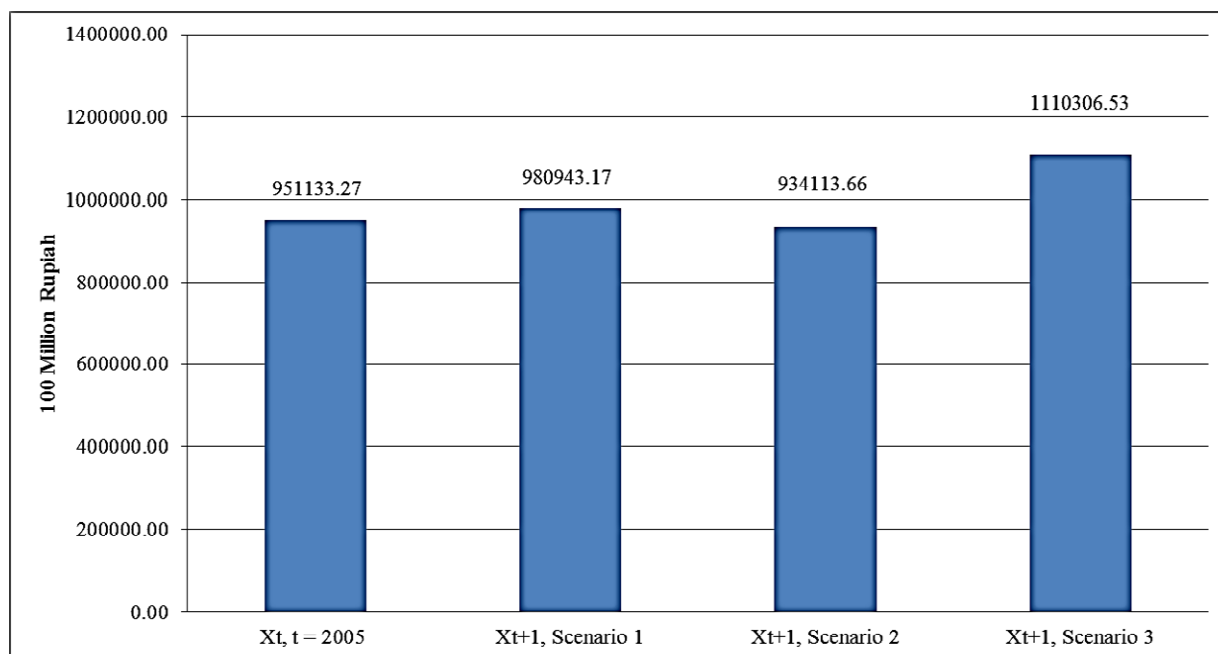(Source: [10] with slight modifications).
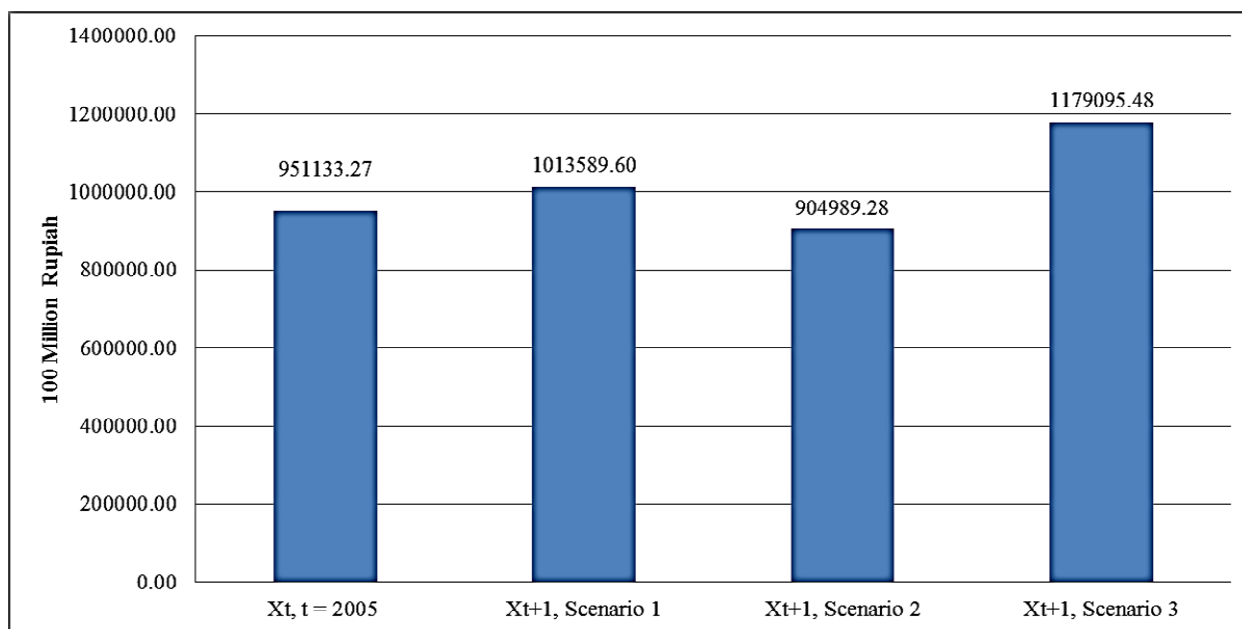
Figure 2. Total output of communication services sector for each scenario on condition A

(Source: [10] with slight modifications).

Figure 3. Total output of construction and installation on electricity, gas, water supply, and communication sector for each scenario on condition B.

Figure 4. Total output of communication services sector for each scenario on condition B.

The maneuver related to the activities of import of ICT sectors, however, has not been discussed. This maneuver is needed because, based on the previous explanations, the change of import will give negative impact. In other words, import activities related to the products of ICT should be avoided if the increasing of total output of above sectors is expected in future period.

Above logic is strengthened by following explanation. Import activities tend to delimitate industrial sectors in producing more outputs. This situation will be worse if the import products have higher competitiveness in the market. The consequence of this circumstance is the decreasing of total output of the sectors in future period. Therefore, the policy related to the import restriction on ICT products is needed in order to make sure the enhancement of total output of ICT sectors.

Obviously, the import activities are still needed by ICT sectors of Indonesia. This fact seems especially on the ICT products which these sectors do not produce. In other words, the import restriction policy should focus on the products of ICT which above sectors have an ability to produce.

5. Conclusions and further research

This study analyzed the impacts of final demand changes on total output of Indonesian ICT sectors using demand-pull IO quantity model. The results of calculation showed that, in analyzed conditions, these sectors had similarities. These were the biggest positive impact to the total output of the sectors was given by the change of households consumption while the change of import had a negative impact. Recommendations in improving Indonesian ICT sectors were compiled based on these characteristics. These were 1) to implement broadband internet service especially on the dense area, 2) to improve the mobile telecommunication access quality, 3) to improve the national postal service, 4) to improve the broadcasting services, 5) to improve the activities related to the ICT commodities export, and 6) to construct import restriction policy for ICT products. This policy should focus on ICT products which above sectors have the capability to generate.

The discussion about the price change in ICT sectors, however, is not explored in this study. In IO approach, analysis of this change will show the impacts of modifications of value added parts on the price of these sectors. In other words, this analysis is also important because it can describe more detail the dynamics of the sectors. Therefore, this analysis is suggested as a further research. Besides, international comparison in the topic of this study, especially comparison among developing and developed countries, will also be an attracting further research. This comparison will show the characteristics of ICT sectors of compared countries.

References

[1]   Grübler A 1998 *Technology and Global Change* (Cambridge: University Press)

[2]   Braun E 2010 The changing role of technology in society *http://epub.oeaw.ac.at/ita/ita-manuscript/ita_10_03.pdf* Accessed 19 October 2013

[3]   Abraham D S 2012 The battle for new resources: Minor minerals in green technologies *http://www.rieti.go.jp/jp/publications/pdp/12p005.pdf* Accessed 19 October 2013

[4]   Peitz M and Waldfogel J 2012 *The Oxford Handbook of the Digital Economy* (Oxford: University Press)

[5]   Bankole F O, Shirazi F and Brown I 2011 Investigating the impact of ICT investments on human development *The Electronic Journal of Information Systems in Developing Countries* **48** 0119

[6]   Zuppo C M 2011 Defining ICT in a boundaryless world: The development of a working hierarchy *International Journal of Managing Information Technology* **4** 1322

[7]   Mtega W P and Msungu A C 2013 Using information and communication technologies for enhancing the accessibility of agricultural information for improved agricultural production in Tanzania *The Electronic Journal of Information Systems in Developing Countries* **56** 0114

[8]   Nasab E H and Aghaei M 2009 The effect of ICT on economic growth: Further evidence *International Bulletin of Business Administration* **5** 4656

[9]   Zuhdi U, Utomo D S and Alamanda D T 2011 Analyzing the role of ICT sector to the national economic structural change: The case of Indonesia *Jurnal Manajemen Teknologi* **10** 299307

[10]   Zuhdi U, Putranto N A R and Prasetyo A D 2014 Encouraging information and communication technology sectors using input-output approach: The case of Indonesia *Advanced Science Letters* **20** 199202

[11] Zuhdi U, Mori S and Kamegai K 2012 Analyzing the role of ICT sector to the national economic structural changes by decomposition analysis: The case of Indonesia and Japan *Procedia-Social and Behavioral Sciences* **65** 749754

[12] Zuhdi U 2014 The other perspective related to the role of information and communication technologies sectors in national economy: The case of Japan *Advanced Science Letters* **20** 483486

[13] Miller R E and Blair P D 2009 *Input-Output Analysis: Foundations and Extensions* (Cambridge: University Press)

[14] Horowitz K J and Planting M A 2006 Concepts and methods of the input-output accounts *http://www.bea.gov/papers/pdf/IOmanual_092906.pdf* Accessed 9 March 2014

[15] Zuhdi U, Prasetyo A D and Sianipar C P M 2013 Analyzing the dynamics of total output of Japanese creative industry sectors: An input-output approach *Procedia Economics and Finance* **5** 827835