Using multipliers analysis in order to get another perspective related to the role of ICT sectors in national economy of Indonesia: 1990-2005

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Abstract. The purpose of this study is to get another perspective related to the role of Information and Communication Technology (ICT) sectors in national economy of Indonesia. The period of analysis of this study is 1990-2005. This study employs Input-Output (IO) analysis as a tool of analysis. More specifically, this study uses simple output multipliers method in order to achieve the purpose. Comparison with previous study is conducted in order to get the objective of this study. Previous study, using Structural Decomposition Analysis (SDA), showed that ICT sectors did not have an important role in Indonesian national economy in above period. The similar results also appear in this study. In other words, from this study, another perspective related to the role of these sectors in Indonesian national economy in analysis period is not found.

1. Introduction
In recent times, technology has become important thing in society. As evidence, every aspect of human life has a relation with technology. For example, mining industries use heavy technologies in doing their activities. Other example could be shown on agricultural sectors. These sectors employ technologies in conducting cultivation activities. Besides, technology changes have the potential to improve the service delivery efficiency within the market of career support, to increase existing services, and to generate career support’s new paradigms [1]. These facts show that the role of technology in improving human life cannot be underestimated in this age [2].

One kind of technology that available in society is an Information and Communication Technology (ICT). ICTs have fundamental roles in modern economic growth and development. These are 1) to reduce the costs of transaction and thereby to increase productivity, 2) to offer a quick connectivity, 3) to replace for other such as physical travel, 4) to add choice in the marketplace and to provide access to goods and services which are unavailable, 5) to extend the scope of area of potential markets, and 6) to distribute all kinds knowledge and information [3]. [4] argued that economic growth theories forecast that investment in ICT drives the growth of economy. [5] explained that economists recognize that ICT and the Internet-related topics are significant parts of activity of economy. These arguments show that ICT has an important role in this age and cannot be separated from human life.

There are many previous studies discussed about ICT. For example, [6] focused on developing a hierarchy of applications and definitions of ICT. [7] examined the relation of ICT and farming community in Uttarakhand state, Indian Himalayan region and explored the ways of integrating ICT with the existing system of public extension. [8] analyzed the impacts of ICT and Foreign Direct Investment (FDI) on growth of productivity of observed countries. Their analysis was based on panel data of 42 developed and
developing countries on the period between 1993 and 2001. On the other hand, [9] explored the ways in encouraging Indonesian ICT sectors using Input-Output (IO) analysis.

However, the study compares the results of previous study, which the topic of discussion is the role of ICT sectors in national economy of specific country, is still lack. The kind of study, actually, is important since it can describe more detail about this role. Besides, the kind of study will give another point of view related to this role. [10] has tried to conduct the kind of study which the object was Japan, one of developed country. The study focuses on this topic, which the object is a specific developing country, actually, is also needed. This study is conducted in order to fulfill this gap.

This study focuses on Indonesia, one of developing country in the world. The purpose of this study is to get another perspective related to the role of ICT sectors in national economy of Indonesia. The period of analysis of this study is 1990-2005. This study employs IO analysis as a tool of analysis. More specifically, this study uses simple output multipliers method in order to achieve the objective. This paper is arranged as follows. Chapter 2 describes the methodology of this study while the results of calculation and analysis of these results are explained in chapter 3. Chapter 4 explored the conclusions of and suggested further researches from this study.

2. Methodology
In this study, IO tables of Indonesia for 1990, 1995, and 2005 are used as data. Following explanation describes the methodology of this study. First, before conducting the calculation, the process of aggregation for above tables is done. The aim of this process is to get the compatibility among different periods. 159 industrial sectors of Indonesia are obtained from this process. ICT sectors of Indonesia used in this study are described from outcome of aggregation process afterwards. Table 1 shows these sectors. The process of adjustment, actually, in order to get the proper data, is addressed to 2005 IO table of Indonesia before conducting the aggregation process.

The previous study have similar topic with this study, actually, is needed in achieving the objective of this study. Therefore, as a second step, we explore the study conducted by [11] as a compared previous study. This previous study analyzed the role of ICT sectors in national economy, refers to the national economic structural changes, of Indonesia on the period between 1990 and 2005 using Structural Decomposition Analysis (SDA), one of analysis tool in IO analysis. In other words, the results of previous study were based on the calculation using this analysis. The data used in their study were same with the data of this study, namely IO tables of Indonesia for 1990, 1995, and 2005. The aggregate and adjustment processes conducted by them are also same with this study, as well as the ICT sectors used.

As described in previous explanation, simple output multipliers method is employed as a tool of analysis. This method is chosen since it can analyze the total production value of all sectors in economy that is needed in satisfying a monetary unit’s worth of final demand for output of particular sector [12]. In other words, this method can analyze the effect of one unit increasing in particular sectors’ final demand on national economy, the total value of production made by all industrial sectors in economy in order to fulfill the escalation. Therefore, the third step in this study is to conduct the calculation using above multipliers method.

As mentioned in previous explanation, method of simple output multipliers is a part of IO analysis. Therefore, the concepts used in this analysis are also applied in this method. The detail of the concepts is described by [12]. According to them, the following equation is used in the simple output multipliers calculation:

\[
m(o)_j = \sum_{i=1}^{n} l_{ij}
\]

where \(m(o)_j\), \(n\), and \(l_{ij}\) are simple output multiplier for sector \(j\), the numbers of sectors, and sector-to-sector multipliers matrix, respectively. Conclusions of this study and suggestions related to the further researches are described on final step.
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])

3. Results and analysis

Tables 2 and 3 describe the results of previous study, namely the top five sectors influencing structural changes in Indonesian national economy, refers to the national economic structural changes, in 1990-1995 and 1995-2005, respectively. ICT sectors, actually, do not exist in these tables. Therefore, according to [11], ICT sectors did not have important role in national economy of Indonesia on the period between 1990 and 2005.

On the other hand, Tables 4, 5, and 6 show the top five industrial sectors of Indonesia viewed from values of simple output multipliers on 1990, 1995, and 2005, respectively. ICT sectors, once again, do not include in the tables. This fact describes that, though using simple output multipliers method, ICT sectors did not have important role in national economy, refers to the total value of production made by all industrial sectors in economy in order to fulfill the increase of one unit in particular sectors’ final demand, of Indonesia on the period between 1990 and 2005.

Table 2. Top five sectors influencing structural changes in the Indonesian national economy, 1990-1995.

| No. | Sector Number | Sector Name                                | Value (100 Million Rupiah) |
|-----|---------------|-------------------------------------------|----------------------------|
| 1   | 137           | Trade                                     | 487268.52                  |
| 2   | 132           | Residential and non-residential buildings  | 306269.37                  |
| 3   | 150           | Business services                         | 238193.25                  |
| 4   | 138           | Restaurant                                | 212883.49                  |
| 5   | 147           | Banking and other financial intermediaries| 202307.68                  |

(Source: [11])

Table 3. Top five sectors influencing structural changes in the Indonesian national economy, 1995-2005.

| No. | Sector Number | Sector Name                                | Value (100 Million Rupiah) |
|-----|---------------|-------------------------------------------|----------------------------|
| 1   | 137           | Trade                                     | 4289107.11                 |
| 2   | 132           | Residential and non-residential buildings  | 2369657.07                 |
| 3   | 138           | Restaurant                                | 1599208.04                 |
| 4   | 134           | Public work on road, bridge, and harbor   | 1437422.16                 |
| 5   | 31            | Crude oil                                 | 1396709.27                 |

(Source: [11])
Table 4. Top five industrial sectors of Indonesia viewed from values of simple output multipliers, 1990.

| No. | Sector Number | Sector Name                                              | Value of Simple Output Multiplier |
|-----|---------------|-----------------------------------------------------------|----------------------------------|
| 1   | 97            | Plastic products                                          | 2.97                             |
| 2   | 112           | Machinery and apparatus                                   | 2.94                             |
| 3   | 66            | Made up textile goods except wearing apparel              | 2.78                             |
| 4   | 68            | Wearing apparel                                           | 2.69                             |
| 5   | 111           | Prime movers engine                                       | 2.68                             |

Table 5. Top five industrial sectors of Indonesia viewed from values of simple output multipliers, 1995.

| No. | Sector Number | Sector Name                                              | Value of Simple Output Multiplier |
|-----|---------------|-----------------------------------------------------------|----------------------------------|
| 1   | 124           | Aircraft and its repair                                   | 2.79                             |
| 2   | 112           | Machinery and apparatus                                   | 2.78                             |
| 3   | 66            | Made up textile goods except wearing apparel              | 2.74                             |
| 4   | 68            | Wearing apparel                                           | 2.69                             |
| 5   | 111           | Prime movers engine                                       | 2.62                             |

Table 6. Top five industrial sectors of Indonesia viewed from values of simple output multipliers, 2005.

| No. | Sector Number | Sector Name                                              | Value of Simple Output Multiplier |
|-----|---------------|-----------------------------------------------------------|----------------------------------|
| 1   | 112           | Machinery and apparatus                                   | 3.00                             |
| 2   | 124           | Aircraft and its repair                                   | 2.99                             |
| 3   | 111           | Prime movers engine                                       | 2.81                             |
| 4   | 127           | Musicals instruments                                      | 2.61                             |
| 5   | 66            | Made up textile goods except wearing apparel              | 2.59                             |

The similar phenomenon also appears on other sectors. These are made up textile goods except wearing apparel and prime movers engine sectors. The values of simple output multiplier of made up textile goods except wearing apparel sector for above tables are 2.78, 2.74, and 2.59, respectively. On the other hand, simple output multiplier values of prime movers engine sector are 2.68, 2.62, and 2.81.

Generally, the composition of sectors in Tables 4, 5, and 6 is similar. This fact indicates that, from the point of view of simple output multipliers, few sectors, in 1990-2005, have dominant positions in Indonesian national economy. More specifically, the national economy of Indonesia on that period did not drastically change.

There are some possibilities in describing above phenomenon, the domination of few sectors in national economy of Indonesia from 1990 through 2005 viewed from simple output multipliers approach. First, these sectors were very attractive on this period. In other words, in 1990-2005, the movements of these sectors in market activities of Indonesia were very mobile so they could control the market. Consequently, in this period, other sectors contributed many inputs to and depended on them when demands came from market.

The second possibility is because of trend of market of Indonesia on the period between 1990 and 2005. Indonesian market in this period might focused on textile products. This trend, actually, would increase the demands for the sectors produce these products. Besides, the other sectors contribute indirectly to this trend, such as the sectors provide the tools and machines for producing textile products, also gain the advantage. Consequently, both sectors have dominant positions in market.

The third possibility is national economy of Indonesia in above period tended to stagnant. The stagnation in national economy of one country, actually, causes its market situation is immovable. Consequently, in 1990-2005, the demands from and the composition of main players in Indonesian market did not drastically change.
Previous explanations show that, using simple output multipliers method, ICT sectors did not have an important role in national economy of Indonesia from 1990 through 2005. In other words, in this study, comparing with previous study, the other perspective related to the role of these sectors in Indonesian national economy in above period does not appear. This phenomenon is interesting to be discussed.

Both methods, SDA and simple output multipliers methods, actually, have different characteristics. As illustration, former method focuses on the change of gross output of industrial sectors between two periods while latter one focuses on specific period. Besides, the values coming from SDA depend on values of decomposition factors while the values of simple output multipliers method relied on final demands of sectors.

The decomposition factors influence the results of SDA are divided into four parts. These are 1) domestic final demand expansion, 2) export expansion, 3) import substitution, and 4) technical coefficient changes. Moreover, expansion of domestic final demand could be elaborated into the four sub-parts, namely 1) household consumption expenditure, 2) consumption expenditure of private, 3) government consumption expenditure, and 4) capital formation and changes in inventory [13]. In other words, seven decomposition factors were employed in previous study. On the other hand, the method of simple output multipliers only has one exogenous variable, namely final demand. Therefore, previous study considers more factors than current study.

Although the characteristics of above both methods are different, the results of calculation using these methods are similar. This phenomenon underlines that ICT sectors did not have an important role in national economy of Indonesia on the period between 1990 and 2005. The growth of these sectors in this period, actually, could describe above situation.

Based on the results of previous calculations, the development of Indonesian ICT sectors in 1990-2005 was not rapid. This condition, actually, caused the movements of these sectors in market were relatively slow. Consequently, the demand for and the dependency of other sectors on these sectors were low. This domino effect, actually, explains why ICT sectors did not have an important role in national economy of Indonesia in this period.

Figures 1, 2, and 3 describe the values of simple output multipliers of all Indonesian industrial sectors on 1990, 1995, and 2005, respectively. Based on information in these figures, the patterns of these values on these years are similar. This phenomenon, actually, indicates that the economic activities of Indonesia in 1990-2005 did not drastically change. This phenomenon, once again, underlines that ICT sectors did not have an important role in national economy of Indonesia in this period.

Table 7 shows the simple output multipliers of ICT sectors of Indonesia from 1990 through 2005. Based on the information in this table, two patterns of simple output multiplier appear on these sectors. These are decreasing-increasing and increasing-decreasing patterns.

The sector has first pattern, decreasing-increasing, is construction and installation on electricity, gas, water supply, and communication. On the other hand, the second pattern, increasing-decreasing, is owned by communication services sector. Therefore, in 1990-2005, ICT sectors of Indonesia had different pattern of simple output multiplier. This difference indicates that the activities conducted by both sectors in market in this period were different. Moreover, this difference also indicates that the dependency level of other sectors on each ICT sector was not same in analysis period. Figure 4 describes more detail about these patterns.

### Table 7. Simple output multipliers of Indonesian ICT sectors.

| No. | Sector Number | Sector Name                                      | 1990 | 1995 | 2005 |
|-----|---------------|--------------------------------------------------|------|------|------|
| 1   | 135           | Construction and installation on electricity, gas, water supply, and communication | 2.48 | 2.34 | 2.49 |
| 2   | 146           | Communication services                            | 1.52 | 1.53 | 1.41 |
Figure 1. The values of simple output multipliers of all industrial sectors of Indonesia, 1990.

Figure 2. The values of simple output multipliers of all industrial sectors of Indonesia, 1995.
4. Conclusions and further researches

This study tries to get another point of view related to the role of ICT sectors in national economy of Indonesia on the period between 1990 and 2005 using simple output multipliers method. Comparison with previous study is conducted in order to get this perspective. Previous study, using SDA, showed that ICT sectors did not have an important role in Indonesian national economy in this period. The similar results also appear in this study. In other words, from this study, another perspective related to the role of these sectors in Indonesian national economy in analysis period is not found.

The other methods, such as income / employment multipliers, value-added multipliers, and statistical analysis methods, however, are not applied in this study. Using these methods in this topic, actually, will generate deeper analysis related to the characteristics of ICT sectors of Indonesia. Consequently, the role of
these sectors in national economy of Indonesia can be explored more detail. Therefore, using other methods in this topic is a suggested further research from this study.

The comparison between two or more countries, such as developed and developing countries, related to the role of ICT sectors in national economy, viewed from simple output multipliers method, is also not conducted in this study. This comparison, actually, will show the differences and similarities of characteristics of these sectors in compared countries. This comparison will also describe the sectors have an important role in national economy of each compared country. Based on these reasons, this study also suggests this comparison as further research.

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