The ranks of Indonesian and Japanese industrial sectors: A further study

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Abstract. The purpose of the current study is to extend the previous study which analyzes the industrial sectors ranks of specific countries. More specifically, the study aims to conduct a further analysis regarding the ranks by using the new data as well as new analysis periods. The study focuses on the cases of Indonesia and Japan. In this study, the analysis period of the Indonesian case is 2010 while for the case of Japan is 2011. Using the previous study as a reference, the study employs the Input-Output (IO) approach as an analysis device. As with the previous study, the results of this study show that the orders of the ranks depend on the methods used. Nevertheless, from the results, one can argue that the electricity and gas industry was a leading sector in the Indonesian economy in 2010. On the other hand, for the case of Japan, the competitive sector in the Japanese economy in 2011 was the manufacturing industry. In terms of the leading sectors, the current study is different from the previous one.

1. Introduction
Industrial sectors are important parts in the economic activities of one country. The importance of sectors can be seen on both macro and micro levels. Therefore, analyzing the industries of a particular country can be an alternative way to know the outlook of its economic situations. Further, the recommendations for improving the economic conditions of the country might be generated from the analysis.

The examples of previous studies which focus on the analysis are [1], [2], [3], [4], [5], and [6]. To the best of my knowledge, after learning the studies, the research which the topic is to determine the ranks of the industrial sectors of countries is still needed. The research is required in order to get the insight about the competitive sectors in the economic activities of focused countries. The current study attempts to fulfill the gap.

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2. Methodology
The methodology of this study refers to the previous study which was conducted by [7]. The first step of the methodology is to expose the data sources. The data sources of this study are the 2010 Indonesian IO table, and Japanese IO table for 2011. The former table is obtained from [8] while the latter one is from [9]. The second step is to explore the industrial sectors of Indonesia and Japan used in this study. Tables 1 and 2 show the industries for the cases of Indonesia and Japan, respectively. The former table consists of seventeen industrial sectors while the latter one is thirteen industries.
The third step is to conduct the calculations in order to determine the ranks of the industrial sectors of discussed countries on the analyzed periods. The methods of backward and forward linkages, the analysis tools in the IO analysis, are employed in the calculations. Both linkages describe the relationship between a particular industrial sector and other industries. More specifically, the backward linkage focuses on the demands of the specific industry on other industrial sectors. These demands appear as a consequence of the industry as a purchaser in the economy. On the other hand, the forward linkage explains the consequence of the industrial sector as a seller.

The methods are suitable for specifying the ranks of industrial sectors on the specific time period. [10] affirm this argument through the following statement:

“Measures have been proposed to quantify such backward and forward linkages, or economic “connectedness.” Comparisons of the strengths of backward and forward linkages for the sectors in a single economy provide one mechanism for identifying “key” or “leading” sectors in that economy (those sectors that are most connected and therefore, in some sense, most “important”) and for grouping sectors into spatial clusters.”

One can argue that if the backward linkage value of sector \( a \) is higher than that of sector \( b \), then sector \( a \) gives more beneficial effect because of the higher capability of the sector in attracting the economy through its demands. The similar argument which uses the supplier’s point of view can be utilized in analyzing the forward linkage values of two or more industries.

This study applies two forms for each linkage, namely “direct” and “total”. These forms can be seen on both demand-side and supply-side IO models. [11] propose the concepts of the former form on both models. To summarize, this form only indicates the straightforward impacts of the demands and supplies of one particular industry. Further, [10] explain the concept of the form on the backward linkage by using the following equation:

\[
BL(d)_j = \sum_{i=1}^{n} a_{ij} \tag{1}
\]

where \( BL(d)_j \), \( a_{ij} \), and \( n \) are the direct backward linkage of sector \( j \), the direct input coefficient, and the number of industrial sectors, respectively. One can calculate \( a_{ij} \) by dividing the value of interindustry sale from sector \( i \) to sector \( j \) by the total outlay of sector \( j \). On the other hand, [12] describes the concept of the form on the forward linkage through the following equation:

\[
F(d)_i = \sum_{j=1}^{n} a_{ij} \tag{2}
\]

where \( F(d)_i \) is the direct forward linkage of sector \( i \). Both equations use the demand-driven IO model as a base. The using of row sums in describing the direct forward linkage of the specific sector in the model is also mentioned by [10].

The insight of the “total” form on the backward linkage in the demand-driven IO model is proposed by Rasmussen (1957) in [10] while [10] explain this on the forward linkage. To summarize, the form describes the straightforward and indirect effects of the demands and supplies of one specific industry. [10] explore the former insight by using the following equation:

\[
BL(t)_j = \sum_{i=1}^{n} l_{ij} \tag{3}
\]

where \( BL(t)_j \) and \( l_{ij} \) are the total backward linkage of sector \( j \), and Leontief inverse or the total requirements matrix, respectively. The latter insight, on the other hand, is explained by [12] by using the following equation:
where \( F(d+i) \), and \( \alpha_{ij} \) are the total forward linkage of sector \( i \), and Leontief inverse matrix, respectively. As with equations (1) and (2), the equations (3) and (4) also use the demand-driven IO model as a base. As a consequence, the supply-driven IO model is a suitable device for analyzing the forward linkage. [10] describe the following equations in representing the linkage which uses the model:

\[
FL(d)_i = \sum_{j=1}^{n} b_{ij}
\]

(5)

\[
FL(t)_i = \sum_{j=1}^{n} g_{ij}
\]

(6)

where \( FL(d)_i \), \( FL(t)_i \), \( b_{ij} \), and \( g_{ij} \) are the direct forward linkage of sector \( i \), the total forward linkage of sector \( i \), the coefficients matrix in a supply-driven IO model, and the Ghosh inverse, respectively. In this study, all above equations are implemented in the calculations step. The next step is to analyze the ranks of Indonesian and Japanese industrial sectors on the analysis periods. Conclusions of this study, and suggestions for further researches are explained on the final step.

**Table 1.** Indonesian industrial sectors used in this study.

| Sector Number | Sector Name |
|---------------|-------------|
| 1             | Agriculture, forestry, and fishing |
| 2             | Mining and quarrying |
| 3             | Manufacturing |
| 4             | Electricity and gas |
| 5             | Water supply, sewerage, waste management, and remediation activities |
| 6             | Construction |
| 7             | Wholesale and retail trade; repair of motor vehicles and motorcycles |
| 8             | Transportation and storage |
| 9             | Accommodation and food service activities |
| 10            | Information and communication |
| 11            | Financial and insurance activities |
| 12            | Real estate activities |
| 13            | Business activities |
| 14            | Public administration and defence; compulsory social security |
| 15            | Education |
| 16            | Human health and social work activities |
| 17            | Other services activities |
Table 2. Japanese industrial sectors used in this study.

| Sector Number | Sector Name                                      |
|---------------|--------------------------------------------------|
| 1             | Agriculture, forestry, and fishery               |
| 2             | Mining                                           |
| 3             | Manufacturing                                    |
| 4             | Construction                                    |
| 5             | Electricity, gas, and water supply               |
| 6             | Commerce                                        |
| 7             | Finance and insurance                           |
| 8             | Real estate                                     |
| 9             | Transport and postal services                    |
| 10            | Information and communications                   |
| 11            | Public administration                            |
| 12            | Services                                         |
| 13            | Activities not elsewhere classified              |

3. Results and analysis

Tables 3 and 4 describe the ranks of Indonesian industrial sectors on the analysis period which are viewed from the calculations results using direct and total backwards linkages, respectively. On the other hand, tables 5 and 6 expose the ranks which are viewed from the results using direct and total forwards linkages, respectively. Meanwhile, the results using the supply-driven IO model for the Indonesian case are explored in tables 7 and 8. The analysis then focuses on the top five sectors of each result. More specifically, one can argue that the sector number 4, electricity and gas, was a leading sector in the Indonesian economy in 2010 because it appears as one of the top five sectors in tables 3 – 8. In other words, on the analysis period, the sector had beneficial effects in the Indonesian economy.

Tables 9 and 10 expose the ranks of Japanese industrial sectors on the analysis period which are viewed from the results of calculations using direct and total backwards linkages, respectively. Meanwhile, tables 11 and 12 describe the ranks which are viewed from the results using direct and total forwards linkages, respectively. On the other hand, the results using the supply-driven IO model for the Japanese case are explored in tables 13 and 14. As with the previous case, the top five sectors on each result are also viewed in the analysis of the Japanese issue. Based on the analysis, one can say that the sector number 3, manufacturing, was a leading sector in the Japanese economy in 2011 because it appears as one of the top five sectors in almost all tables which explain the ranks. In other words, on the analysis period, the sector had beneficial effects in the Japanese economy.

Table 3. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (1).

| Sector Number | Sector Name                                  | Calculated Value |
|---------------|----------------------------------------------|------------------|
| 4             | Electricity and gas                          | 0.765            |
| 6             | Construction                                 | 0.649            |
| 3             | Manufacturing                                | 0.635            |
| 8             | Transportation and storage                   | 0.575            |
| 16            | Human health and social work activities      | 0.545            |
| 9             | Accommodation and food service activities    | 0.542            |
Table 4. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (2).

| Sector Number | Sector Name                                               | Calculated Value |
|---------------|-----------------------------------------------------------|------------------|
| 4             | Electricity and gas                                       | 2.889            |
| 6             | Construction                                              | 2.300            |
| 8             | Transportation and storage                                | 2.184            |
| 3             | Manufacturing                                             | 2.150            |
| 16            | Human health and social work activities                   | 2.071            |
| 17            | Other services activities                                 | 1.996            |
| 9             | Accommodation and food service activities                 | 1.994            |
| 13            | Business activities                                       | 1.774            |
| 14            | Public administration and defence; compulsory social security | 1.752            |
| 10            | Information and communication                             | 1.695            |
| 15            | Education                                                 | 1.688            |
| 7             | Wholesale and retail trade; repair of motor vehicles and motorcycles | 1.651            |
| 11            | Financial and insurance activities                        | 1.486            |
| 2             | Mining and quarrying                                     | 1.472            |
| 1             | Agriculture, forestry, and fishing                        | 1.357            |
| 12            | Real estate activities                                    | 1.349            |
| 5             | Water supply, sewerage, waste management, and remediation activities | 1.348            |

Table 5. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (3).

| Sector Number | Sector Name                                               | Calculated Value |
|---------------|-----------------------------------------------------------|------------------|
| 3             | Manufacturing                                             | 2.740            |
| 4             | Electricity and gas                                       | 0.565            |
| 7             | Wholesale and retail trade; repair of motor vehicles and motorcycles | 0.542            |
| 10            | Information and communication                             | 0.462            |
| 1             | Agriculture, forestry, and fishing                        | 0.426            |
| 2             | Mining and quarrying                                     | 0.374            |
| 8             | Transportation and storage                                | 0.362            |
| 11            | Financial and insurance activities                        | 0.359            |
| 17            | Other services activities                                 | 0.297            |
| 6             | Construction                                              | 0.268            |
Table 6. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (4).

| Sector Number | Sector Name                                           | Calculated Value |
|---------------|-------------------------------------------------------|------------------|
| 3             | Manufacturing                                         | 6.436            |
| 1             | Agriculture, forestry, and fishing                    | 2.309            |
| 4             | Electricity and gas                                   | 2.217            |
| 2             | Mining and quarrying                                  | 2.203            |
| 7             | Wholesale and retail trade; repair of motor vehicles and motorcycles | 2.072            |
| 10            | Information and communication                         | 1.767            |
| 8             | Transportation and storage                            | 1.614            |
| 11            | Financial and insurance activities                    | 1.606            |
| 13            | Business activities                                   | 1.450            |
| 17            | Other services activities                             | 1.427            |
| 6             | Construction                                          | 1.410            |
| 9             | Accommodation and food service activities             | 1.236            |
| 14            | Public administration and defence; compulsory social security | 1.114            |
| 16            | Human health and social work activities               | 1.107            |
| 12            | Real estate activities                                | 1.068            |
| 5             | Water supply, sewerage, waste management, and remediation activities | 1.068            |
| 15            | Education                                             | 1.052            |

Table 7. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (5).

| Sector Number | Sector Name                                           | Calculated Value |
|---------------|-------------------------------------------------------|------------------|
| 13            | Business activities                                   | 0.820            |
| 4             | Electricity and gas                                   | 0.720            |
| 2             | Mining and quarrying                                  | 0.677            |
| 11            | Financial and insurance activities                    | 0.673            |
| 1             | Agriculture, forestry, and fishing                    | 0.656            |
| 3             | Manufacturing                                          | 0.654            |
| 5             | Water supply, sewerage, waste management, and remediation activities | 0.638            |
| 10            | Information and communication                         | 0.574            |
| 8             | Transportation and storage                            | 0.503            |
| 7             | Wholesale and retail trade; repair of motor vehicles and motorcycles | 0.417            |
| 17            | Other services activities                             | 0.355            |
| 9             | Accommodation and food service activities             | 0.244            |
| 16            | Human health and social work activities               | 0.142            |
| 12            | Real estate activities                                | 0.129            |
Table 8. The ranks of Indonesian industrial sectors on the analysis period, based on the results of calculations using equation (6).

| Sector Number | Sector Name                                                        | Calculated Value |
|---------------|-------------------------------------------------------------------|------------------|
| 4             | Electricity and gas                                                | 2.801            |
| 13            | Business activities                                                | 2.598            |
| 2             | Mining and quarrying                                               | 2.458            |
| 1             | Agriculture, forestry, and fishing                                 | 2.367            |
| 5             | Water supply, sewerage, waste management, and remediation activities | 2.300            |
| 11            | Financial and insurance activities                                 | 2.298            |
| 3             | Manufacturing                                                      | 2.186            |
| 10            | Information and communication                                      | 2.108            |
| 8             | Transportation and storage                                         | 1.890            |
| 7             | Wholesale and retail trade; repair of motor vehicles and motorcycles| 1.758            |
| 17            | Other services activities                                          | 1.586            |
| 9             | Accommodation and food service activities                          | 1.369            |
| 12            | Real estate activities                                             | 1.233            |
| 16            | Human health and social work activities                            | 1.218            |
| 6             | Construction                                                       | 1.165            |
| 14            | Public administration and defence; compulsory social security       | 1.163            |
| 15            | Education                                                          | 1.071            |

Table 9. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (1).

| Sector Number | Sector Name                                                      | Calculated Value |
|---------------|------------------------------------------------------------------|------------------|
| 5             | Electricity, gas, and water supply                                | 0.730            |
| 3             | Manufacturing                                                    | 0.715            |
| 13            | Activities not elsewhere classified                               | 0.601            |
| 2             | Mining                                                            | 0.553            |
| 4             | Construction                                                      | 0.548            |
| 1             | Agriculture, forestry, and fishery                                | 0.515            |
| 9             | Transport and postal services                                     | 0.497            |
| 10            | Information and communications                                    | 0.474            |
| 12            | Services                                                          | 0.384            |
| 7             | Finance and insurance                                             | 0.342            |
| 11            | Public administration                                             | 0.317            |
| 6             | Commerce                                                          | 0.315            |
| 8             | Real estate                                                       | 0.194            |

Table 10. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (2).

| Sector Number | Sector Name                                                      | Calculated Value |
|---------------|------------------------------------------------------------------|------------------|
| 3             | Manufacturing                                                    | 2.769            |
| 5             | Electricity, gas, and water supply                                | 2.625            |
| 4             | Construction                                                      | 2.268            |
| 1             | Agriculture, forestry, and fishery                                | 2.210            |
| 2             | Mining                                                            | 2.181            |
| 13            | Activities not elsewhere classified                               | 2.160            |
| 9             | Transport and postal services                                     | 2.077            |
| 10            | Information and communications                                    | 1.935            |
| 12            | Services                                                          | 1.840            |
| 11            | Public administration                                             | 1.664            |
| 7             | Finance and insurance                                             | 1.658            |
| 6             | Commerce                                                          | 1.627            |
| 8             | Real estate                                                       | 1.361            |
Table 11. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (3).

| Sector Number | Sector Name                       | Calculated Value |
|---------------|-----------------------------------|------------------|
| 3             | Manufacturing                     | 1.664            |
| 12            | Services                          | 1.197            |
| 9             | Transport and postal services     | 0.772            |
| 10            | Information and communications    | 0.417            |
| 6             | Commerce                          | 0.364            |
| 2             | Mining                            | 0.335            |
| 7             | Finance and insurance             | 0.312            |
| 5             | Electricity, gas, and water supply| 0.289            |
| 11            | Public administration             | 0.227            |
| 8             | Real estate                       | 0.203            |
| 4             | Construction                      | 0.170            |
| 1             | Agriculture, forestry, and fishery| 0.155            |
| 13            | Activities not elsewhere classified| 0.080           |

Table 12. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (4).

| Sector Number | Sector Name                       | Calculated Value |
|---------------|-----------------------------------|------------------|
| 3             | Manufacturing                     | 5.629            |
| 12            | Services                          | 3.379            |
| 9             | Transport and postal services     | 2.455            |
| 6             | Commerce                          | 1.871            |
| 10            | Information and communications    | 1.767            |
| 2             | Mining                            | 1.763            |
| 5             | Electricity, gas, and water supply| 1.582            |
| 7             | Finance and insurance             | 1.521            |
| 8             | Real estate                       | 1.363            |
| 1             | Agriculture, forestry, and fishery| 1.336            |
| 4             | Construction                      | 1.297            |
| 11            | Public administration             | 1.261            |
| 13            | Activities not elsewhere classified| 1.151           |

Table 13. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (5).

| Sector Number | Sector Name                       | Calculated Value |
|---------------|-----------------------------------|------------------|
| 2             | Mining                            | 31.701           |
| 13            | Activities not elsewhere classified| 1.003           |
| 1             | Agriculture, forestry, and fishery| 0.887            |
| 5             | Electricity, gas, and water supply| 0.690            |
| 3             | Manufacturing                     | 0.668            |
| 9             | Transport and postal services     | 0.645            |
| 10            | Information and communications    | 0.552            |
| 7             | Finance and insurance             | 0.517            |
| 6             | Commerce                          | 0.378            |
| 12            | Services                          | 0.360            |
| 4             | Construction                      | 0.186            |
| 8             | Real estate                       | 0.167            |
| 11            | Public administration             | 0.029            |

Table 14. The ranks of Japanese industrial sectors on the analysis period, based on the results of calculations using equation (6).

| Sector Number | Sector Name                       | Calculated Value |
|---------------|-----------------------------------|------------------|
| 2             | Mining                            | 82.632           |
| 1             | Agriculture, forestry, and fishery| 3.276            |
| 13            | Activities not elsewhere classified| 3.072           |
| 9             | Transport and postal services     | 2.722            |
| 5             | Electricity, gas, and water supply| 2.597            |
| 3             | Manufacturing                     | 2.583            |
| 10            | Information and communications    | 2.087            |
| 7             | Finance and insurance             | 1.970            |
| 6             | Commerce                          | 1.837            |
| 12            | Services                          | 1.755            |
| 4             | Construction                      | 1.358            |
| 8             | Real estate                       | 1.329            |
| 11            | Public administration             | 1.089            |
4. Conclusions and further researches
This study, as a continuation study of the previous one, determines the ranks of Indonesian and Japanese industries by using the analysis methods in the IO analysis, backward and forward linkages, and new data as well as new analysis periods for the focused countries. As with the previous study, the results of the current study show that the orders of the ranks depend on the methods used. Nevertheless, from the results, one can argue that the electricity and gas industry was a leading sector in the Indonesian economy in 2010. On the other hand, for the Japanese case, the sector which had the beneficial effects in the Japanese economy in 2011 was the manufacturing industry. In terms of the leading sectors, the current study is different from the previous one.

The suggested further research from the current study is to expand the analyzed industrial sectors for each analyzed country. This suggestion is mentioned in order to get the deeper understanding regarding the economic conditions of analyzed countries on the specific period of analysis, especially about the ranks of their industries. This deeper understanding might be useful in determining the prioritized sectors on their economic activities in the future. The other suggested further research is to expand the area of analysis using the same methodology so the industrial sectors ranks of, for example, the specific region can also be analyzed. One of the examples is to expand the analysis for the other ASEAN countries.

References
[1] Zuhdi U 2014 The impacts of final demand changes on total output of Indonesian ICT sectors: an analysis using input-output approach IOP Conference Series: Materials Science and Engineering 58 012011
[2] 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 5 827–35
[3] Zuhdi U 2012 Analyzing the influence of creative industry sector to the national economic structural changes by decomposition analysis: the case of Indonesia Procedia-Social and Behavioral Sciences 65 980–5
[4] Zuhdi U, Utomo D S and Alamanda D T 2011 Analyzing the role of ICT sector to the national economic structural changes: the case of Indonesia Jurnal Manajemen Teknologi 10 299–307
[5] Zuhdi U 2015 An application of input-output analysis in analyzing the impacts of final demands changes on the total outputs of Japanese energy sectors: a further study Journal of Physics: Conference Series 622 012041
[6] Zuhdi U, Mori S and Kamegai K 2014 Analysis of influences of GDP and ICT on Indonesian industrial structural changes using statistical analysis: 1990-2005 Journal of Finance and Accountancy 17 1–19
[7] Zuhdi U 2016 The ranks of Indonesian and Japanese industrial sectors IOP Conference Series: Earth and Environmental Science 38 012008
[8] BPS-Statistics Indonesia 2016 Statistical Yearbook of Indonesia 2016 [online] https://www.bps.go.id/website/pdf_publikasi/Statistik-Indonesia-2016--_rev.pdf (accessed December 30, 2016)
[9] Japanese Ministry of Internal Affairs and Communications 2016 2011 Input-Output Tables for Japan [online] http://www.soumu.go.jp/main_content/000443188.pdf (accessed December 30, 2016)
[10] Miller R E and Blair P D 2009 Input-Output Analysis: Foundations and Extensions (Cambridge: University Press)
[11] Chenery H B and Watanabe T 1958 International comparisons of the structure of productions Econometrica 4 487–521
[12] Nazara S 2005 Input-Output Analysis [in Indonesian] (Jakarta: The Faculty of Economics of University of Indonesia)
[13] Zuhdi U 2014 Analyzing the impacts of final demand changes on total output using input-output approach: the case of Japanese ICT sectors IOP Conference Series: Earth and Environmental Science 19 012016
[14] Zuhdi U 2014 Analyzing the role of creative industries in national economy of Japan: 1995-2005 Open Journal of Applied Sciences 4 197–211
[15] Zuhdi U 2014 An input-output approach to analyze the ways to increase total output of energy sectors: the case of Japan IOP Conference Series: Earth and Environmental Science 19 012015
[16] Zuhdi U 2014 The dynamics of total output of Indonesian information and communication technology sector when final demand changes occur: an analysis using input-output approach Advanced Science Letters 20 2254–57
[17] 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 20 483–6
[18] Zuhdi U 2014 The role of information and communication technology sectors in Indonesian national economy from 1990 through 2008: an analysis using input-output approach Advanced Science Letters 20 1932–5
[19] Zuhdi U 2014 Using multipliers analysis in order to get another perspective related to the role of ICT sectors in national economy of Indonesia: 1990-2005 Journal of Physics: Conference Series 495 012051
[20] Zuhdi U 2015 An analysis of the role of information and communication technology sectors on Japanese national economy from 1995 through 2005: an application of multiplier analysis IOP Conference Series: Earth and Environmental Science 23 012014
[21] Zuhdi U 2015 An application of multiplier analysis in analyzing the role of information and communication technology sectors on Indonesian national economy: 1990-2005 IOP Conference Series: Earth and Environmental Science 23 012015
[22] Zuhdi U 2015 The dynamics of Indonesian creative industry sectors: an analysis using input-output approach Journal of the Knowledge Economy 6 1177–90
[23] Zuhdi U 2016 The dynamics of the total output of the fishery sector: the case of Indonesia Journal of Physics: Conference Series 710 012039
[24] Zuhdi U 2016 The dynamics of the total output of the Japanese fisheries sector: an analysis using input-output approach Journal of Physics: Conference Series 710 012040
[25] Zuhdi U 2016 The dynamics of the total outputs of Japanese information and communication technology sectors: a further study Journal of Physics: Conference Series 710 012041
[26] Zuhdi U 2016 The Indonesian economy in 2005: an analysis using the input-output approach Proceedings of 20th EBES Conference-Vienna 3 1825–42
[27] 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 65 749–54
[28] Zuhdi U, Mori S and Kamegai K 2013 Analysis of influences of ICT on structural changes in Japanese commerce, business services and office supplies, and personal services sectors using multivariate analysis: 1985-2005 The Asian Journal of Technology Management 6 102–11
[29] Zuhdi U, Mori S and Kamegai K 2014 Statistical analysis of influences of ICT on industrial structure changes from 1985 through 2005: the case of Japan Journal of Computers 9 1291–9
[30] Zuhdi U, Mori S and Kamegai K 2015 Forecasting the influences of information and communication technology on the structural changes of Japanese industrial sectors: a study using statistical analysis International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering 9 531–7
[31] Zuhdi U and Prasetyo A D 2014 Examining the total output changes of ICT sectors of Japan: an approach of input-output Procedia-Social and Behavioral Sciences 109 659–63
[32] Zuhdi U, Prasetyo A D and Putranto N A R 2014 Analyzing the changes of total output of Japanese livestock sector: an input-output approach Procedia-Social and Behavioral Sciences 109 649–53
[33] Zuhdi U, Putranto N A R and Prasetyo A D 2014 An input-output approach to know the dynamics of total output of livestock sectors: the case of Indonesia Procedia-Social and Behavioral Sciences 109 634–8
[34] 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 20 199–202
