International Journal of Advanced Science and Technology
Vol. 29, No. 8, (2020), pp. 1589-1600

Exploring Strategies For Utilizing Appropriate Technologies (AT) For ODA (Official Development Assistance) Projects

Young-Chool Choi[1], Hak-Sil Kim[2]
[1]*Professor, Associate Professor*[2]
[1,2]*Department of Public Administration, Chungbuk National University, Korea*
Email: ycchoi@cbu.ac.kr

Abstract

The purpose of this study is to provide appropriate information in response to attempts to assist developing countries by means of Appropriate Technology. Today, OECD members, including Korea, have many appropriate technologies that can be applied to developing countries, and can continue to develop these technologies in the future. However, if appropriate technologies are applied to developing countries, there is a possibility that they will fail. For example, the transfer of proper technology may fail if attempts are made to move to a state-of-the-art technology center without considering the situation of developing countries, or if the local operators cannot maintain and repair the machine in question due to the nature of the technology. This study was conducted from the viewpoint of considering not only the advantages, but also the disadvantages, of Appropriate Technology in transferring it to developing countries. In this perspective, it is necessary to establish what are the most important issues relating to the transfer of Appropriate Technology. To do this, we attempted to derive a group of topics related to Appropriate Technology by analyzing 90 academic papers that have the words "Appropriate Technology" as their title. We employed a text network analysis method, which resulted in 7 subject groups being derived.

1. Introduction

According to the criteria for classifying the countries receiving aid from the OECD DAC, the total number of countries receiving aid in 2020 is 142. Of course, the number of countries receiving aid each year varies slightly; in the last few years, it has been around a hundred and forty. These countries fall into four major categories, ranging from the lowest group, with per capita GNI of under $1005, to the highest, with per capita GNI under $12235. The primary goal of providing aid to these countries is to help them develop their economies, increase their job totals, and increase their income levels. To do this, one of the various approaches is to transfer the technology appropriate to the economic level of the recipient country. This technique is termed "Appropriate Technology." However, a variety of conditions need to be present to ensure that these appropriate technologies transfer well to the recipient countries, and that they can be successfully commercialized in less developed countries. In examining these substantive issues relating to Appropriate Technology, in this study we will employ the text network method.

2. Theoretical Review

2.1 Concept and importance of Appropriate Technology

"Appropriate Technology" refers to technology that is applied for the purposes of improving quality of life and eradicating poverty, mainly taking into account the cultural, political, and environmental aspects of the developing countries. Appropriate Technology is also called "intermediate technology", "alternative technology", "borderless science technology", etc., because it is a medium-scale technology situated between advanced technology and sub-technology. Appropriate Technology as applied to less developed countries in Africa and Asia is related to water shortages, disease, and poverty, and will contribute to solving problems such as illiteracy and to providing new jobs. Even in developed countries, Appropriate Technology can suggest the direction of technological development useful for solving social problems faced by marginalized groups. Such technology is seen as possessing several advantages. It offers benefits to many people as ping countries, provides no polluting emissions, and minimizes energy resource consumption. It can assist in incorporating appropriate technologies into advanced technologies, so as to solve poverty and foster economic

ISSN: 2005-4238 IJAST

development in developing countries, and provide start-ups to aid poor people in social enterprises. However, although it is a technology that can improve quality of life with minimal effort by taking into account the situation in the specific region, it is difficult to generalize from the results precisely because these are limited to a specific region. In addition, there is also the possibility of error in respect of the technology.

2.2 Appropriate Technology and intellectual property rights

In developed countries, many intellectual property rights are registered annually and protected as exclusive rights. Korea, for example, is the world's fourth-largest country in terms of patent registration. That is, about 100,000 patents and utility model rights are registered every year. In Korea, patents are granted as exclusive rights to patent owners for twenty years from the date of registration, and utility model rights are granted for ten years. After twenty years and ten years respectively, everyone can use patents and utility model rights: in other words, anyone can use and commercialize intellectual property rights that have expired. For example, if the patent was registered in Korea before 2000, the rights protection period ends in 2020, so anyone can use the rights from 2021 on. One important point here is that Korea's per capita GDP in 1999 was $10,400. However, Vietnam, which receives the most aid from Korea, has a per capita GDP of around $2,500 in 2019. In other words, in terms of per capita GDP, even patents registered in Korea in 1999 are perfectly applicable to developing countries such as Vietnam. There are around 2 million such intellectual property rights in Korea alone. Commercializing the intellectual property rights of OECD DAC members such as the USA, the UK, and France, as well as the millions of intellectual property rights which have expired in developing countries, constitutes a very effective ODA strategy. Such intellectual property rights are to be included in the category of Appropriate Technology, and are held to have importance in ODA policy (Bixler, 2011; Corbett & Bikkert, 2012;,Karabarbounis & Neiman, 2013).

Another important factor in appropriate technology for ODA is that it can be constructed from materials and components that are readily available locally, and therefore it is easy to produce locally. These optimum-technology products can create new jobs in the region and bring economic benefits (Aker and Mbiti., 2010; DE LA GRANDVILLE, 1989; Hall, 2012)..

In addition, from a scientific point of view, appropriate technology normally uses skills which are available in a local community, so it is necessary to use materials and technology suitable for the local situation. Therefore, Appropriate Technology is being studied as a method of utilizing renewable energy sources or reducing the use of fossil fuels (Klump et al., 2007; Laporte & Smith, 2017)..

Appropriate Technology is very important in that it utilizes the intellectual property rights of advanced countries. However, despite this, very little research has been conducted on how to use Appropriate Technology well in the ODA field (Barro & Martin, 2003;Brocklehurst & Harvey, 2007). This is due to lack of consideration of a number of issues pertaining to Appropriate Technology per se. The characteristics of Appropriate Technology need to be fully examined in advance, as do the conditions necessary for it to settle in a developing country. This study aims to meet this need.

3. Research Design

3.*1 Analysis target*

In order to analyze the above-mentioned issues, this study analyzes academic journal articles that contain the words "Appropriate Technology". More precisely, we analyze the abstracts of papers that contain the words "appropriate technology" in their title. Due to the large number of international journals, this study comprises only academic papers included in 148 journals managed by the world-leading publisher Springer. This is because the software program to be used in this study, the Netminer program, can directly access Springer's journal articles.

3.2 Analysis method

ISSN: 2005-4238 IJAST

In this study, the text network analysis method is applied. The reason for this is that this method not only derives the main keywords included in the text, but also analyzes how one keyword and other keywords co-occur in one sentence, and how often. It also analyzes how several words in a text form a group of subjects.

3.3 Analysis procedure

The analysis procedure in this study can be summarized as follows. First, we extract papers that include the words "Appropriate Technology" in the title. Second, we collect the abstracts of these papers and ascertain which keywords occur in the text. Third, keywords are sorted in the order of their occurrence. Fourth, among the keywords, meaningless words are removed and 100 keywords are then extracted in order of their frequency. Fifth, these 100 keywords are made into matrix data, and consolidation analysis and subject group classification analysis are performed on the created data. Sixth, via this analysis, a group of major issues relating to Appropriate Technology are explored.

4. Analysis of Issues surrounding Appropriate Technology

4.1 Word-cloud analysis

Word-cloud analysis is performed in order to look at the general characteristics of the important keywords relating to Appropriate Technology. In the journal articles managed by Springer, the number of articles with "Appropriate Technology" in the article title is 90, and the number of important keywords included in these articles 1623. The word-cloud analysis of these words is shown in Figure 1.

Figure 1 Analysis of the issues surrounding Appropriate Technology by word-cloud analysis method

From the 1623 words, meaningless words were excluded, and then the rest of the words were rearranged in order of frequency of occurrence. Among the rearranged words, 100 words with a frequency of 5 or more were selected and analyzed. The word-cloud analysis results for these 100

ISSN: 2005-4238 IJAST

words are shown in Figure 2. The most frequent word was “technology”, which appeared 181 times, followed by “development” (59 times) and then the phrase “Appropriate Technology” (58 times).

Figure 2 Word-cloud analysis of reduced keywords

4.2 Subject group classification

Next, we analyzed which of the important 100 keywords selected play a role in the text, and how these topics might be grouped. For this purpose a topic analysis was conducted, using the Netminer software program. Topic analysis is used to classify text-use into several major subject groups by using the frequency and relationship of the simultaneous occurrence of keywords included in the text. From this analysis, 7 subject groups were found. Figure 3 shows the status of these 7 topics. The large circle size in each subject group means that this term plays an important role in that subject group.

ISSN: 2005-4238 IJAST

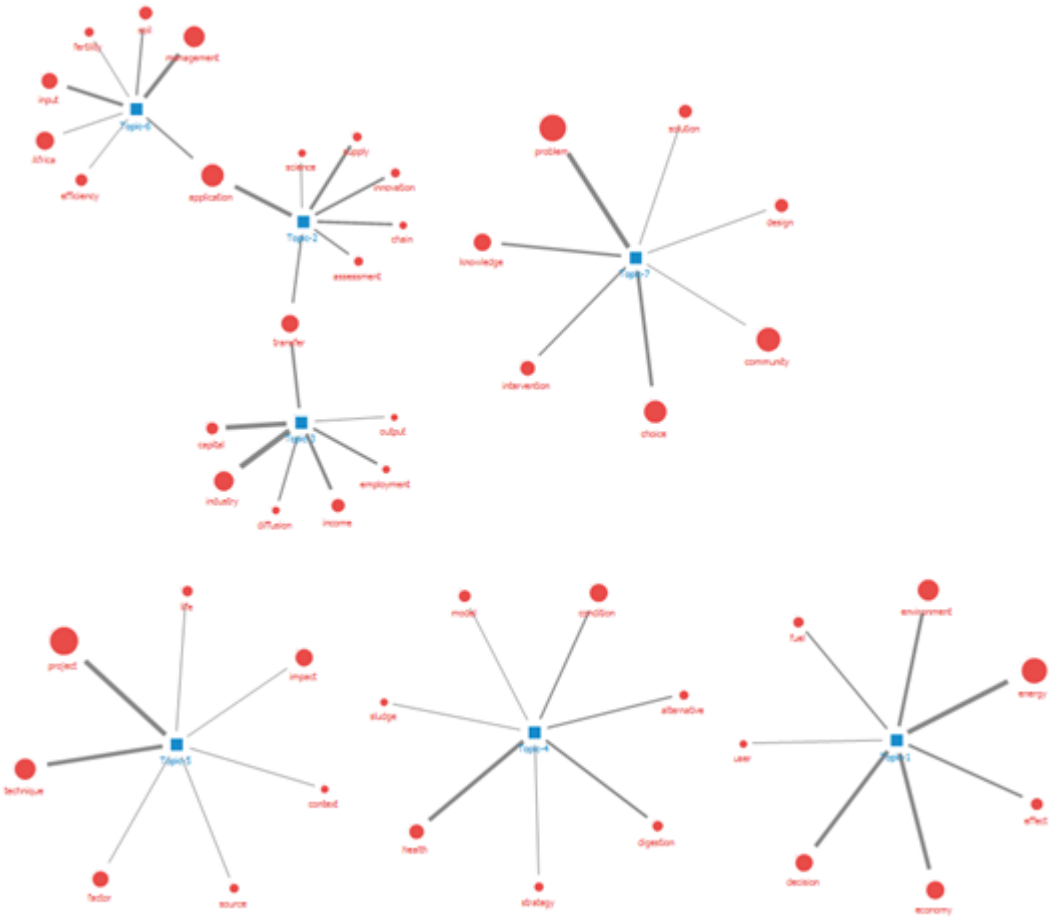

Figure 3 Results of topic analysis (7 subject groups)

After the topic analysis being conducted, the 100 keywords were reduced to 47, and the analysis of the concentric circles of these 47 main keywords is shown in the concentric circle analysis results in Figure 4. As the concentric circle shows, the most central keywords can be said to be the central keywords playing an important role in the subject group.

ISSN: 2005-4238 IJAST

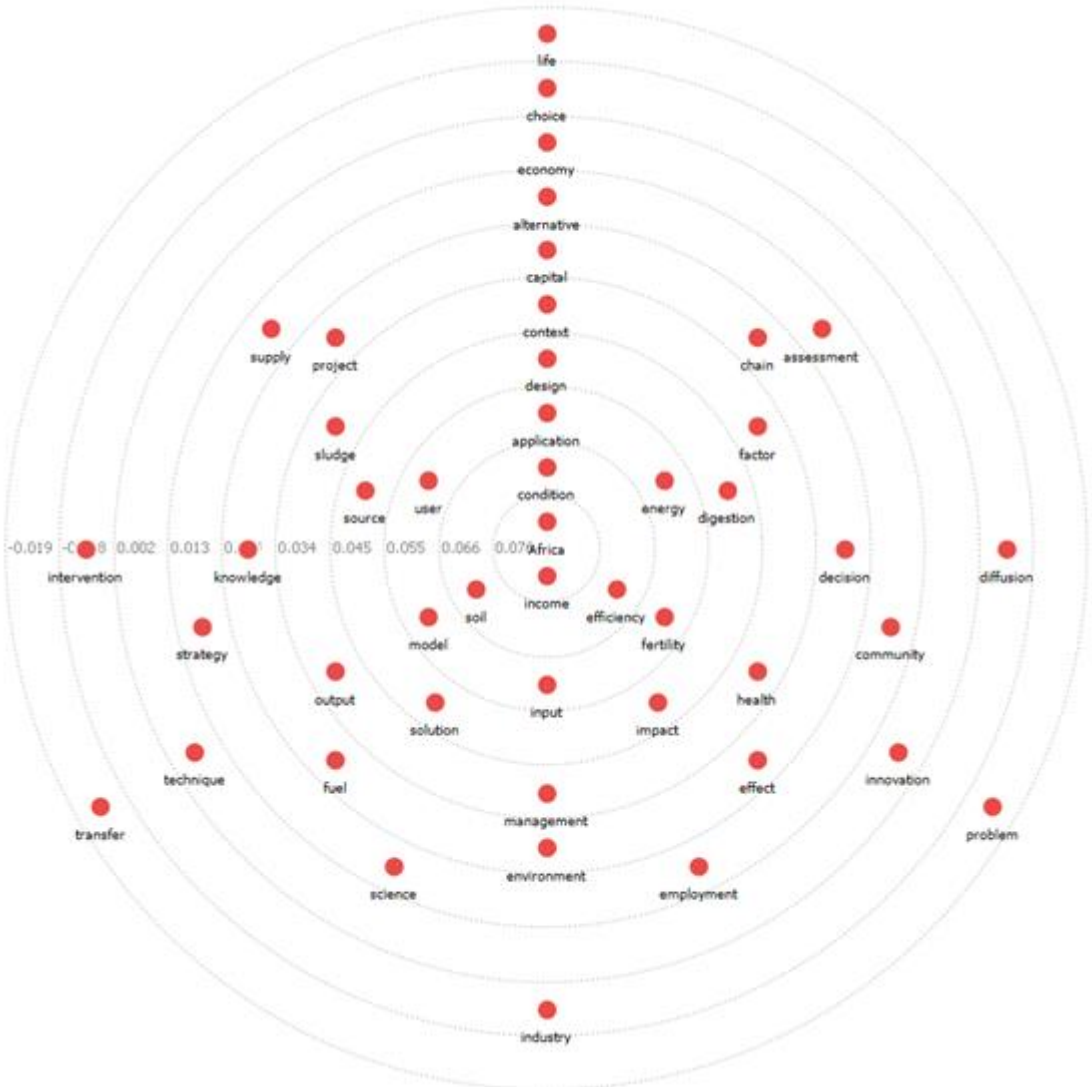

Figure 4 Concentric circle analysis results

As the concentric analysis results show, “Africa” and “income” are at the very center. This means that Africa is often referred to as the main continent for the transfer of Appropriate Technology. It also suggests that income generation will be an important goal of Appropriate Technology.

ISSN: 2005-4238 IJAST

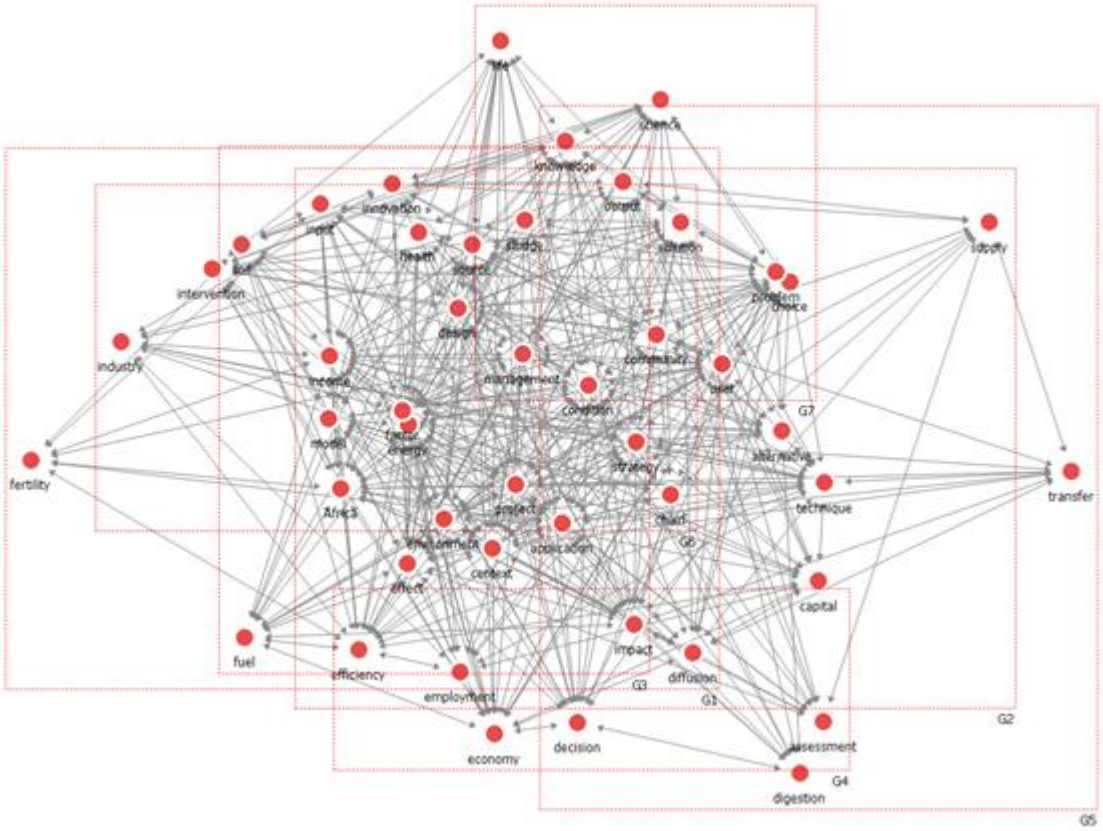

Figure 5 Results of partition analysis

Partition analysis, the results of which are shown in Figure 5, is a way of showing which subject groups are the main keywords that form the network. The difference between this analysis and the topic analysis presented in Figure 3 is that in the topic analysis, seven topic groups are created, but there are keywords that overlap, whereas in partition analysis subject groups are formed mutually exclusively. Figure 6 shows the results for each keyword's degree-centrality analysis. It shows how each keyword is connected with other keywords.

ISSN: 2005-4238 IJAST

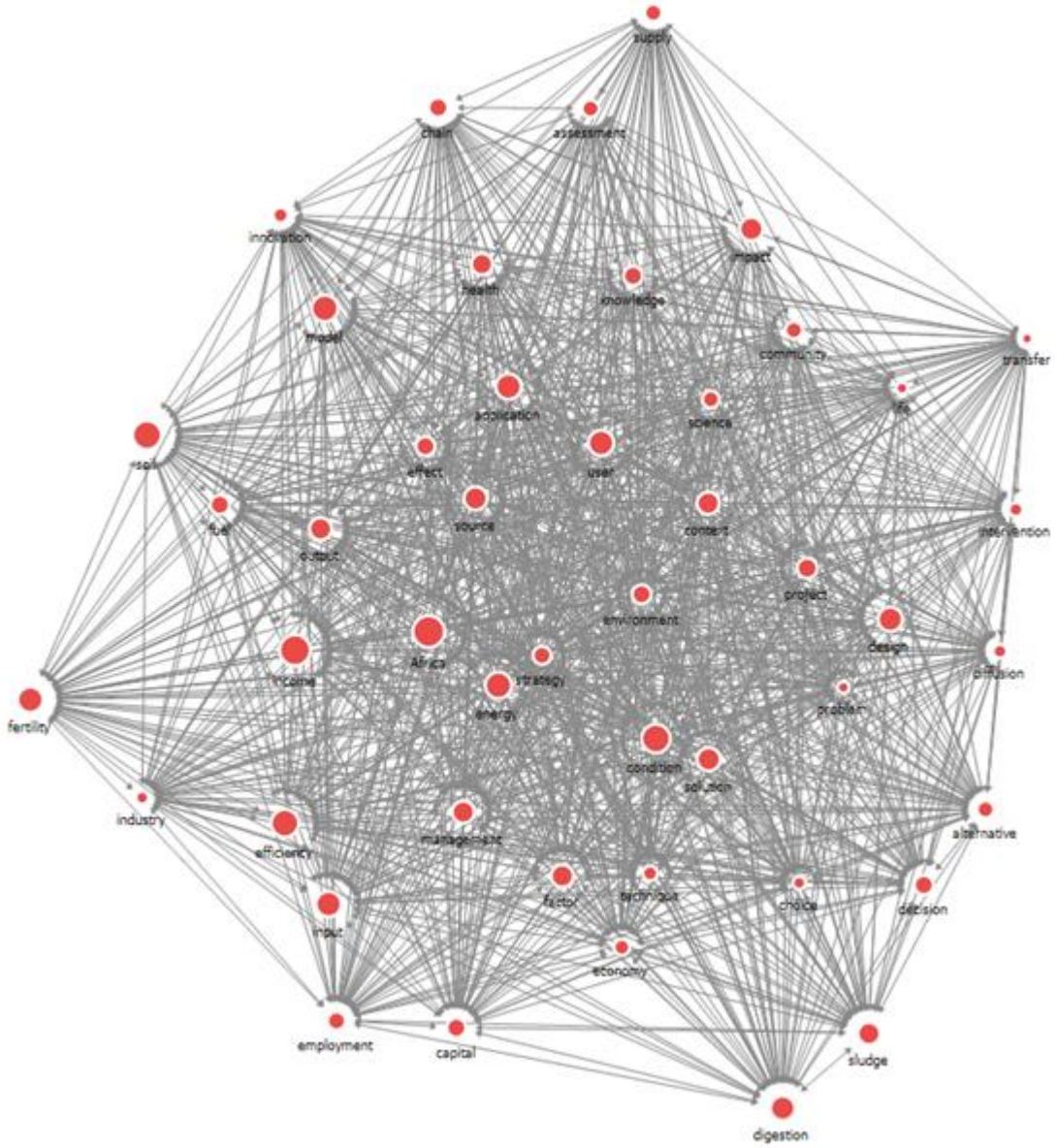

Figure 6 Results of degree-centrality analysis

Table 1 shows the main components included in the seven subject groups. Topic 1 includes *projects*, *communities*, *knowledge*, *sources*, and *life*. This group of topics suggests that Appropriate Technology can be a provider of quality of life in the community. Topic 2 consists of *energy*, *health*, *fuel*, *effects*, and *environment*. This is a group of topics which emphasize that Appropriate Technology can affect energy, the environment, and health. Topic 3 includes *industry*, *options*, *factors*, *techniques*, and *income*. This group of themes suggests that Appropriate Technology can be developed to create income-related industries. Topic 4 consists of *management*, *input*, *Africa*, *soil*, and *application*. This group of topics 4 suggests that Appropriate Technology will likely be applied to Africa. Topic 5 consists of *problem*, *economy*, *capital*, *solution*, and *condition*. This topic text means that conditions in the countries receiving aid are important in terms of whether proper technology will succeed. Topic 6 consists of *decision*, *supply*, *impact*, *assessment*, and *environment*. This topic group suggests that an assessment of the environment of the recipient country should be undertaken prior to the application of Appropriate Technology. Finally, topic 7 includes *transfer*, *model*, *technique*, *user*, and *innovation*. This group of topics suggests that the transfer of Appropriate Technology should be carried out to foster innovation in the countries aided.

ISSN: 2005-4238 IJAST

Table 1 Main words of topics 1–7

TOPIC INFO

	1st Keyword	2nd Keyword	3rd Keyword	4th Keyword	5th Keyword
Topic-1	project	community	knowledge	source	life
Topic-2	energy	health	fuel	effect	environment
Topic-3	industry	choice	factor	technique	income
Topic-4	management	input	Africa	soil	application
Topic-5	problem	economy	capital	solution	condition
Topic-6	decision	impact	supply	assessment	environment
Topic-7	transfer	model	technique	user	innovation

Table 2 shows the relationship between the 47 major key words and the 7 topics.

Table 2 Characteristics of words organized by topic

	Topic-1	Topic-2	Topic-3	Topic-4	Topic-5	Topic-6	Topic-7
Africa	0.005054	0.01249	0.003611	0.105111	0.007491	0.00296	0.02331
alternative	0.00191	0.005419	0.004027	0.052682	0.011668	0.001661	0.012461
application	0.001375	0.038739	0.002133	0.085483	0.00315	0.058894	0.017418
assessment	0.002847	0.002788	0.001641	0.001018	0.001637	0.085921	0.005221
capital	0.001352	0.001896	0.001961	0.001309	0.120678	0.001422	0.002691
chain	0.002868	0.002202	0.001595	0.001203	0.002851	0.074162	0.004471
choice	0.009272	0.00205	0.15222	0.001765	0.052027	0.002081	0.005013
community	0.149338	0.007281	0.00192	0.001643	0.005155	0.065892	0.012314
condition	0.050004	0.011249	0.002043	0.01707	0.06557	0.003034	0.032681
context	0.032811	0.008851	0.002944	0.003577	0.009618	0.003599	0.030857
decision	0.003149	0.005399	0.002323	0.003834	0.001726	0.15001	0.002984
design	0.049263	0.002591	0.010738	0.014924	0.012052	0.024076	0.021521
diffusion	0.00659	0.003625	0.001854	0.001519	0.065356	0.001737	0.014972
digestion	0.001582	0.002573	0.001125	0.080578	0.001386	0.001396	0.003178
economy	0.002123	0.028776	0.002389	0.001517	0.153042	0.0034	0.004651
effect	0.001858	0.090986	0.00151	0.001515	0.004074	0.007279	0.027917
efficiency	0.001386	0.004967	0.006526	0.080947	0.002079	0.001718	0.006483
employment	0.002708	0.001906	0.073384	0.001334	0.002231	0.003014	0.00252
energy	0.00213	0.281015	0.002179	0.004476	0.001789	0.002241	0.007167
environment	0.00722	0.061072	0.00734	0.002128	0.003938	0.083305	0.039976
factor	0.00424	0.002284	0.1311	0.002829	0.00424	0.006757	0.003585
fertility	0.001117	0.00156	0.001125	0.073819	0.001362	0.001151	0.001743
fuel	0.002147	0.099021	0.002295	0.000918	0.001652	0.001925	0.015968
health	0.002523	0.102921	0.002608	0.001839	0.002617	0.031085	0.009376

ISSN: 2005-4238 IJAST

impact	0.036381	0.012065	0.002113	0.001937	0.002225	0.10537	0.012362
income	0.003569	0.006427	0.095524	0.013218	0.004044	0.002189	0.005125
industry	0.001518	0.001717	0.177216	0.001021	0.002558	0.001632	0.002792
innovation	0.006959	0.026351	0.023383	0.001447	0.002334	0.002755	0.050288
input	0.002612	0.001709	0.001631	0.11721	0.00135	0.001683	0.002281
intervention	0.019821	0.004037	0.003243	0.001314	0.003588	0.074326	0.04597
knowledge	0.140918	0.00834	0.004763	0.001205	0.003056	0.002444	0.006072
life	0.054136	0.006965	0.002247	0.0056	0.013152	0.00357	0.025486
management	0.001352	0.003433	0.002504	0.129041	0.030108	0.001654	0.001718
model	0.001364	0.036732	0.001489	0.001818	0.001349	0.001521	0.097576
output	0.001585	0.002031	0.064468	0.001233	0.002153	0.001782	0.003026
problem	0.005421	0.00805	0.024651	0.001314	0.271352	0.010024	0.003804
project	0.261574	0.006347	0.002889	0.003126	0.005141	0.03553	0.005752
science	0.006363	0.015168	0.021141	0.003011	0.007044	0.00366	0.038584
sludge	0.001359	0.002291	0.001658	0.059803	0.004158	0.001824	0.002815
soil	0.001229	0.002151	0.001125	0.099562	0.002282	0.001717	0.001894
solution	0.017315	0.003586	0.020736	0.006378	0.080394	0.004134	0.005874
source	0.074502	0.001701	0.004257	0.001633	0.011297	0.001804	0.003318
strategy	0.00443	0.028524	0.006966	0.001208	0.00203	0.020671	0.048759
supply	0.001241	0.001729	0.002319	0.001242	0.002	0.088028	0.004224
technique	0.006123	0.009629	0.107738	0.002308	0.00296	0.00781	0.076966
transfer	0.002747	0.001601	0.004141	0.001115	0.002128	0.001788	0.192715
user	0.00261	0.027754	0.003209	0.001218	0.005904	0.005363	0.054122

On the other hand, Figure 7 shows how the 7 topics may be divided into four dimensions. This is useful for the purposes of integrating the topics and using them in policy.

ISSN: 2005-4238 IJAST

Figure 7 Keywords classified by four dimensions

The reduction result achieved by the multi-dimensional scaling method above can be used for the policy development of Appropriate Technology by using information on the dimensional and mutual distance relations among the important keywords.

5. Conclusion

Appropriate Technology has many advantages, but at the same time there are many problems (Polak & Warwick, 2013; Zobel, 2013; Osterwalder et al., 2010; Piketty, 2013; Piketty & Saez, 2003). The transfer of Appropriate Technology may fail even if the attempt is to move to a state-of-the-art technology center if the circumstances of the developing countries are not taken into account, or if local operators cannot maintain and repair the machine in question due to the nature of the Appropriate Technology used. In addition, there are various factors that can lead to failure, such as when it is expensive to supply appropriate technologies. This study was conducted from the viewpoint of considering not only the advantages but also the disadvantages of Appropriate Technology. In this perspective, it was necessary to understand various important issues relating to the transfer of Appropriate Technology (among other things), and to ascertain what are the important issues relating to Appropriate Technology per se. To this end, we tried to derive a group of topics relating to Appropriate Technology by analyzing 90 academic papers that have the phrase “appropriate technology” as the title of the paper. As an analysis method, text network analysis was mobilized. As a result, seven subject groups were derived. From the point of view of assisting developing countries in the future by using appropriate technologies, if we consider the seven subject groups presented in this study we will increase the probability of success and reduce the probability of failure.

Acknowledgements: This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2016S1A5A2A03927173)

ISSN: 2005-4238 IJAST

References

1. Aker, Jenny C., and Isaac M. Mbiti. (2010). Mobile Phones and Economic Development in Africa. ,*Journal of Economic Perspectives*, 24(3): 207-32.
2. BARRO, R. E. and SALA-I MARTÍN, X. (2003), *Economic Growth*, 2nd edn. (MIT Press).
3. Bixler, G. (2011). *Extreme User Centered Design: Methodology for Soliciting and Ranking*
4. *Requirements in User-Centered New Product Development*, GHTC, IEEE
5. Brocklehurst, C. & Harvey, P. (2007). *An Evaluation of the PlayPump® Water System as an*
6. *Appropriate Technology for Water, Sanitation and Hygiene Programmes*, UNICEF.
7. Corbett, S., & Fikkert, B. (2012). *When helping hurts: how to alleviate poverty without hurting the poor-- and yourself*, Chicago: Moody.
8. DE LA GRANDVILLE, O. (1989), "In Quest of the Slutsky Diamond", *The American Economic Review*, 79, 468–481.
9. DRANDAKIS, E. M. and PHELPS, E. S. (1966), "AModel of Induced Invention, Growth and Distribution", *The Economic Journal*, 76, 823–840.
10. GALÍ, J. (1999), "Technology, Employment, and the Business Cycle: Do Technology Shocks Explain Aggregate Fluctuations?", *American Economic Review*, 89, 249–271.
11. HALL, R. E. (2012), "The Cyclical Response of Advertising Refutes Counter-Cyclical Profit Margins in Favor of Product-
12. Market Frictions" (NBER Working Papers 18370, National Bureau of Economic Research).
13. KARABARBOUNIS, L. and NEIMAN, B. (2013), "The Global Decline of the Labour Share", The Quarterly Journal of
14. Economics, 129, 61–103.
15. KLUMP, R., MCADAM, P. and WILLMAN, A. (2007), "Factor Substitution and Factor-Augmenting Technical Progress in the United States: A Normalized Supply-Side System Approach", The Review of Economics and Statistics, 89,
16. 183–192.
17. LaPorte, D, Kim, E, & Smith, J (2017). Engineering to Help Communities or Students' Development? An Ethnographic Case Study of an Engineering-to-Help Student Organization, *International Journal For Service Learning In Engineering*, 12, 2, pp. 103-117.
18. Osterwalder, A., Pigneur, Y., & Clark, T. (2010). *Business model generation: A handbook for visionaries, game changers, and challengers*, Hoboken: Wiley.
19. Polak, P., & Warwick, M. (2013). *The business solution to poverty: designing products and services for three billion new customers,* San Francisco: Berrett-Koehler, Inc.
20. Zobel, G. (2013, August). Alfredo Moser: Bottle light inventor proud to be poor, Retrieved from http://www.bbc.com/news/magazine-23536914
21. PIKETTY, T. (2013), Capital in the Twenty-First Century (Cambridge: Harvard University Press).
22. PIKETTY, T. and SAEZ, E. (2003), "Income Inequality in the United States", 1913–1998, The Quarterly Journal of Economics, 118, 1–41.

ISSN: 2005-4238 IJAST