

Analysis of Trends in Cooperative Network Patterns for KAERI Researchers

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1. Introduction

There has been a trend toward faster results of research and accelerating inter-disciplinary convergence, under constraints in available resources. Under such reality, national and international cooperation with inter-sectoral research on science-technology-industry is becoming inevitable as a strategic approach for enhancing competitive edge on global dimension.

This study gives an analysis on the cooperative network in nuclear research which bears multi-disciplinary technical feature. The study aims to visualize the cooperative network of KAERI(Korea Atomic Energy Research Institute) researchers, as the hub of the network, including academics and industry, with a view to provide insight on strengthening the cooperative network in nuclear research.

2. Analysis Methods and Results

This study examined the paper entries in SCI(E) in 2013(538 papers) and 2015(551 papers), which were authored or co-authored by KAERI researchers. The two years span of 2013 and 2015 are chosen in order to compare longer term trend, skipping the year 2014.

2.1. Visualization Technique

In this study, visualization of connectivity by social network was shown, with degree of centrality, by using Kamada-Kawai algorithm. A node in the network signifies at least a connection with KAERI researcher by co-authoring of a paper. The drawing of Kamada-Kawai spring (spring-KK) is a technique for optimizing distance between nearby nodes while maintaining optimal distances with nodes that are not adjacent. The size of network nodes is visualized by the number of co-authoring with KAERI researchers and the partner organizations and more than 5 papers co-authored with KAERI are marked with their names.

2.2. International Cooperation

Figure 1 visualizes the status of international cooperation of KAERI researchers with other countries.

In 2013, the frequency of international cooperation activities were accounted for USA (41), Japan (12), India (9), Canada/Russia/UK (6 each), Switzerland/Czech (5 each), Germany/France/China (4 each), Pakistan (3), Spain/Egypt/Australia (2 each), and Slovenia/Poland/Netherland/Italy/Indonesia/Croatia/Australia (1 each).

Figure 2 shows the case of 2015, accounted for USA (34), China (11), India (10), Japan (10), Russia (8), Taiwan/Germany (5 each), Spain (4), Vietnam /UK/ France/Czech (3 each), SouthAfrica/Netherland/ Malaysia/Canada/Australia (2 each), Ukraine / Switzerland/Sweden/ Portugal/ Monaco/ Italy/ Iran/ Indonesia/Greece/Brazil/Belgium/Austria (1 each).

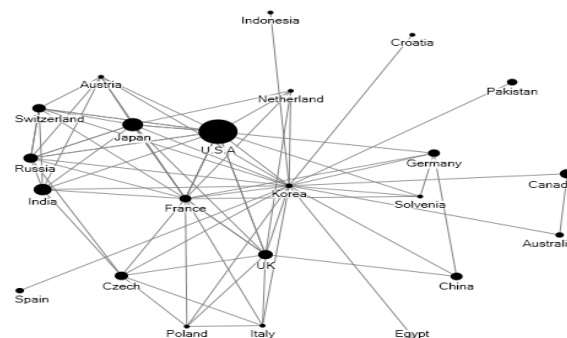


Fig. 1. International research network of KAERI researchers in 2013

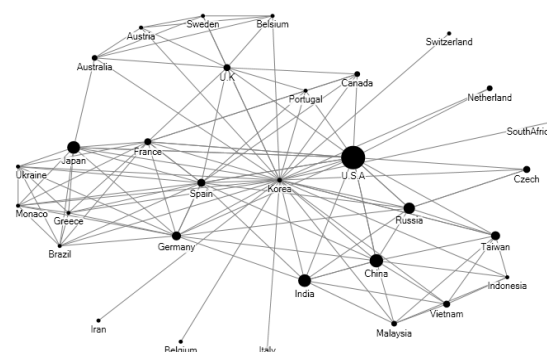


Fig. 2. International cooperation network of KAERI researchers in 2015.

2.3. Domestic Cooperation

A total of 176 SCI(E) papers were accounted for 2013 and 2015, with a view to identify cooperation activities of KAERI researchers with domestic organizations.

Figure 3 visualizes the status of domestic cooperation of KAERI researchers with other institutes and universities.

In 2013, the frequency of domestic cooperation activities were accounted for KAIST (32), Chungnam University/Hanyang University/Seoul National University (18 each), Chonnam National University / Kangwon National University, Yonsei University (12 each) Kyungpook National University (11), Kongju University/NFRI (9 each), Chonbuk National University/ Gwang ju Institute of Science & Technology/ Korea University/ Kyungpook National University/Pusan University (8 each), Gyeongsang University/Korea Institute of Nuclear Safety/ Kyunghee University/POSCO (7 each), Dongguk University /Sogang University/UNIST (6 each), NFRI and Pukyong University (5 each).

Figure 4 shows the case of 2015 visualizes the status of domestic cooperation of KAERI researchers with other institutes and universities.

For the frequencies of cooperative activities in 2015 with respect to 2013, in terms of organizations, KAIST accounted for 36 compared to 32, POSCO 7 to 5, while the number of organizations has decreased from 26 in 2013 to 25 in 2015, due to the drop in frequencies of co-authored papers to 4.

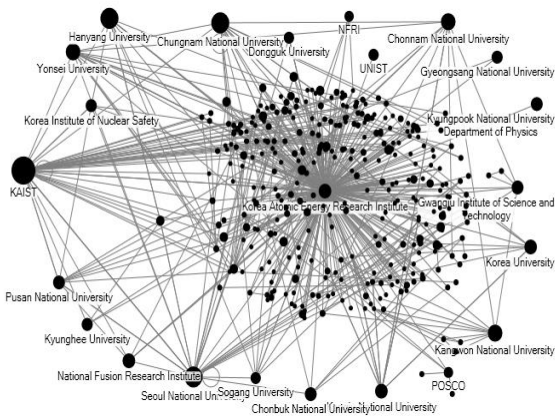


Fig. 3. Domestic cooperation network of KAERI researchers in 2013

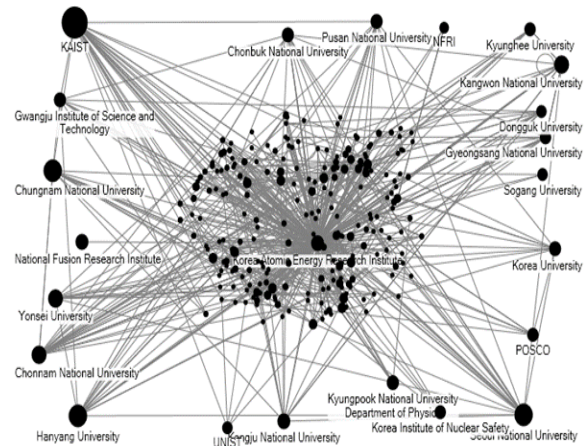


Fig. 4. Domestic network of KAERI researchers in 2015

3. Conclusion

This study accounted for the paper entries in SCI(E) in 2013 (538 papers) and 2015 (551 papers) with a view to identify cooperative research activities centered for KAERI.

On international cooperation, the analysis showed a trend toward, first of all, diversification of partner countries. There were 118 entries of co-authorship with 22 countries in 2013 (41 with USA, 12 with Japan, 9 with India), which evolved to 121 entries in 2015 (34 for USA, 11 with China, 10 each with Japan and India). Secondly, there was a trend toward more number of countries evenly spread in 2015 compared to 2013, except a few major countries like USA, Japan, and India. On cooperation with domestic organizations, there showed no noticeable trend between 2015 and 2013, meaning the research cooperation activities are based on longer term programmes for 2~3 years. To identify more notable trend, longer series analysis at an interval of 3 or 5 years would be required.

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