Result of the survey for EA-RTM2019

-The Future of Medical Engineering Collaboration-

Part 1: Survey on Cooperation Indicator

Necessity and benefit of the technological cooperation of 3 East-Asian countries are positively perceived among most of the respondents. Although Japanese respondents are relatively pessimistic, the tendencies are similar in 3 academies.

In terms of quantity/quality of current cooperation and future prospect, NAEK and EAJ showed very similar tendencies, namely they are relatively pessimistic compared to CAE. It is interesting that CAE showed bisected answers of "relatively high" and "low" in quality recognition. This might suggest that current quality level has not been satisfied, since respondents have large prospect for future collaborations.

Part 2: Fact finding survey

As for the three questions regarding the recognition on the significance of technical cooperation in the field of medical-engineering collaborations, responses from the three academies were similar with those of the responses to general questions showed in Part 1.

For fruitful collaboration, three academies all think the common research activities are the keys. However, the recognition on the promising fields are rather different due to the area. For the general area for medical-engineering collaboration, answers are distributed to many topics, though, "Immunotherapy" is one of the topics which is thought to be particularly important by CAE respondents. On the other hand, "Regenerative medicine," "Genomic medicine," and "Materials for medical applications" are commonly recognized as important topics. Respondents from NAEK think "Sensor networking for medicine" and "Integrative management/analysis of various medical data" are particularly important, while EAJ respondents put emphasis on "AI analysis for medicine."

In the area of "healthy-life extension," all academies think "Health monitoring" is definitely necessary. In addition, it is agreed that "Social/Human resource management systems" backed-up by "Social demands" are the key factor to apply the technology. This combination, "Social/Human resource management systems" supported by "Social demands," is also thought to be important for "Welfare support" area. One of a few differences of responses is observed in the satisfaction level of "Elder population supports" and "Welfare supports." The peaks of the answers locate in the higher level in CAE compared to NAEK and EAJ. This answer can be affected by the public support on this issue and perhaps the cultural background to support elderlies which is a common cultural tradition of 3 East Asian countries plays a role.

Part 3: Personal information

About the personal information of the respondents, there are not big differences from the preceding surveys. Most of the respondents have long experience regarding the scientific/engineering research. The largest difference can be seen in the percentage of respondents who have experienced some collaborative projects with other countries. The percentage is evidently higher in EAJ. Along with the small number of respondents from EAJ, this suggest that those who have not experienced collaborations didn't show intention to answer to the questionnaire.

Overall summary:

Except for the aforementioned small differences, the tendencies of the answers from three academies are surprising similar, comparing to the previous topics in the EA-RTM. This fact suggests us that rapidly progressing aging society is a common concern and a big challenge for China, Korean and Japan. As for the specific research area, "Regenerative medicine," "B: Genomic medicine" and "Materials for medical applications" can be commonly agreed for collaborative projects among three academies. For CAE and EAJ, "Non-invasive health monitoring" can be added for the field of collaboration. For CAE and NAEK, "Integrative management/analysis of various medical data," and for NAEK and EAJ, "Sensor networking for medicine," and "AI analysis for medicine" might be other options for collaboration.

In order to promote medical-engineering collaborations, three academies think frameworks for "Social/Human resource management" is important. And "Social demands" are definitely important in progressing the studies and asking for public support.

Part 1: Survey on Cooperation Indicator

I-1. Do you think technological cooperation is necessary among China, Japan, and Korea?

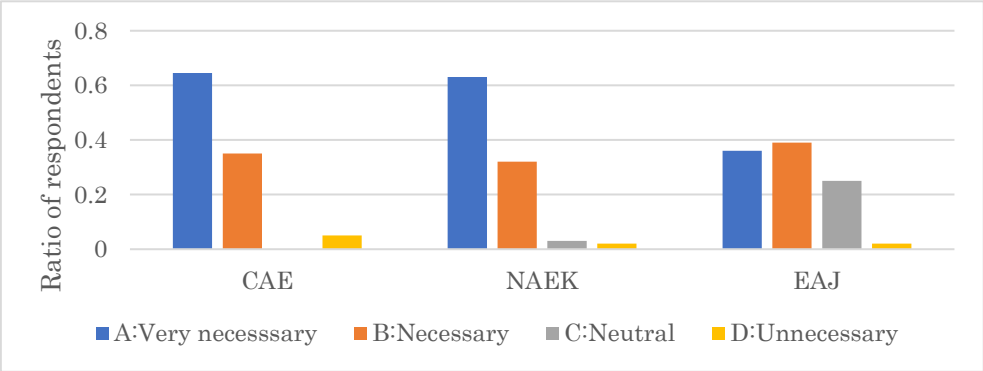


Fig.1 Recognition on the necessity of technological cooperation

I-2. Do you think technological cooperation among China, Japan, and Korea would be mutually beneficial?

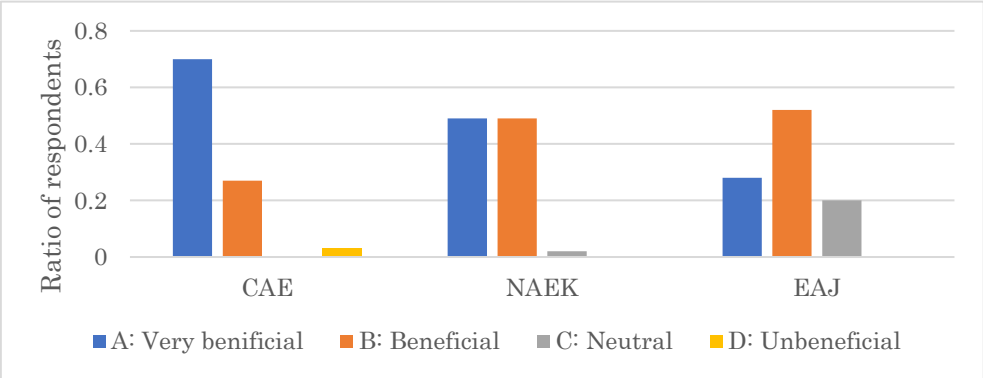


Fig.2 Recognition on the benefit of technological cooperation

I-3. In terms of quantity, how would you evaluate the level of technological cooperation among China, Japan, and Korea?

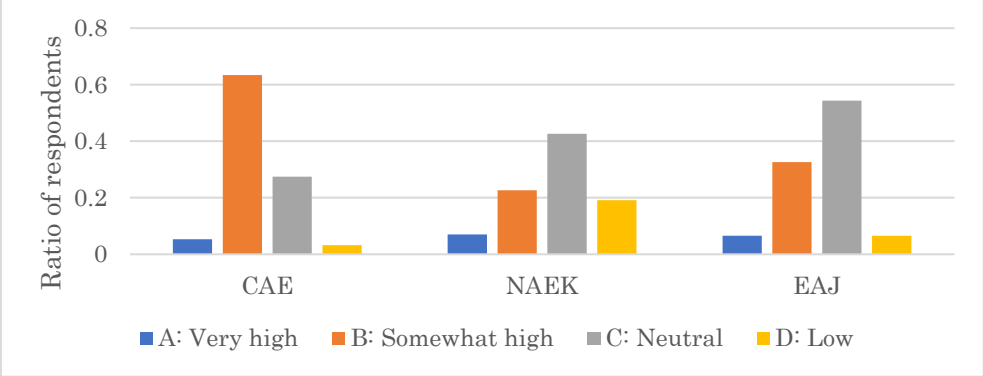


Fig.3 Recognition on the quantity of technological cooperation

I-4. In terms of quality, how would you evaluate the level of technological cooperation among China, Japan, and Korea?

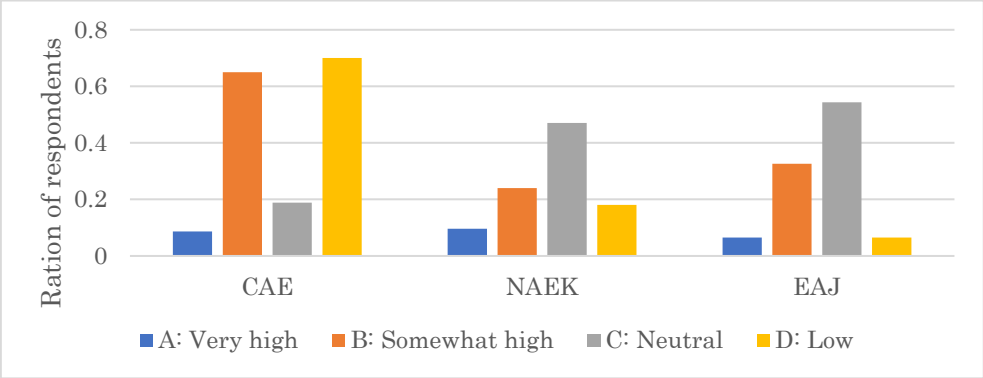


Fig.4 Recognition on the quality of technological cooperation

I-5. What is your opinion on the future prospects for technological cooperation among China, Japan, and Korea?

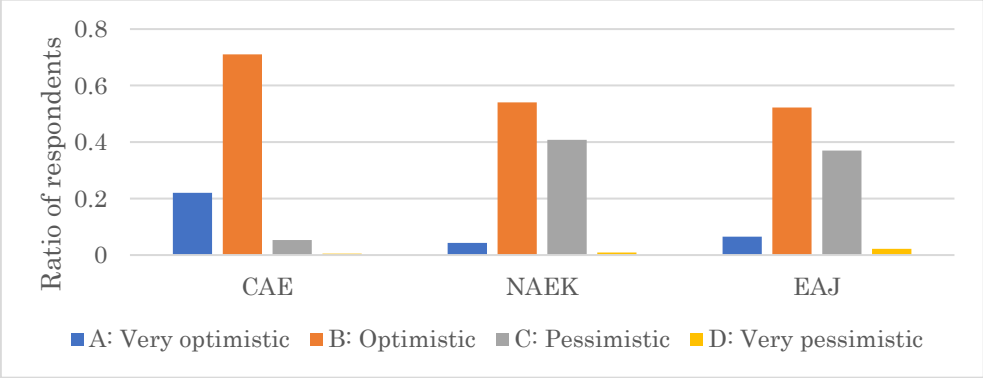
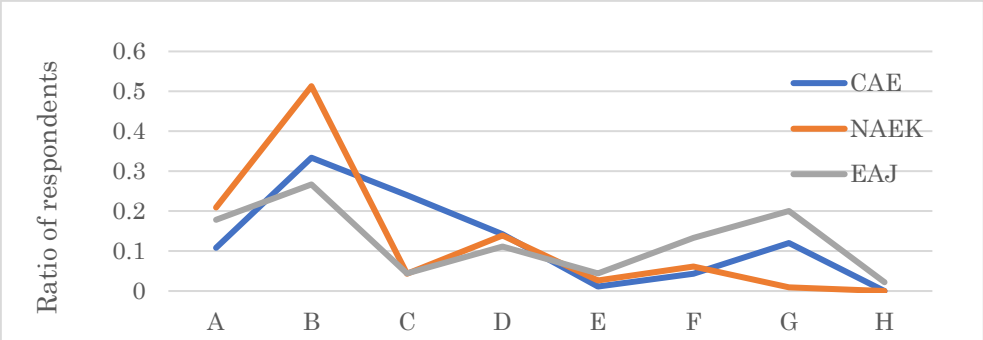


Fig.5 Recognition on the future prospect of technological cooperation

Part 2: Fact finding survey

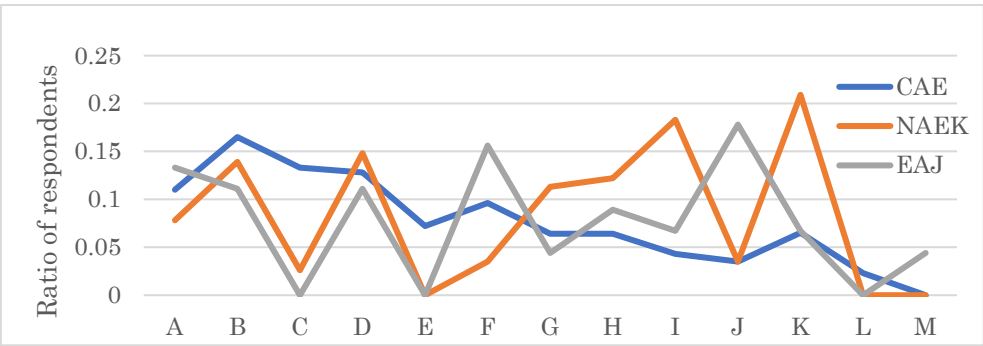
II-1.1 What is the most important issue for successful medical-engineering collaborations?



A: Collaboration opportunities, B: Common Research activities, C: Technology requirement for Translational Medicine, D: Industrial Demand, E: Education for collaboration, F: Financial supports by the government, G: Social Demand, H: Others

Fig.6 Recognition on the key factor for successful collaborations

II-1.2 What is the most promising field for medical-engineering collaboration?



A: Regenerative medicine, B: Genomic medicine, C: Immunotherapy, D: Materials for medical applications, E: Medicinal chemistry, F: Non-invasive health monitoring, G: Medical imaging, H: Surgical robots/devices, I: Sensor networking for medicine, J: AI analysis for medicine, K: Integrative management/analysis of various medical data, L: Virtual-/Augmented-/Mixed-reality visualization of medical data, M: Others

Fig.7 Recognition on promising field for collaboration

II-1.3 What do you think is the importance of the collaboration among Japan, China and Korea in medical-engineering collaboration?

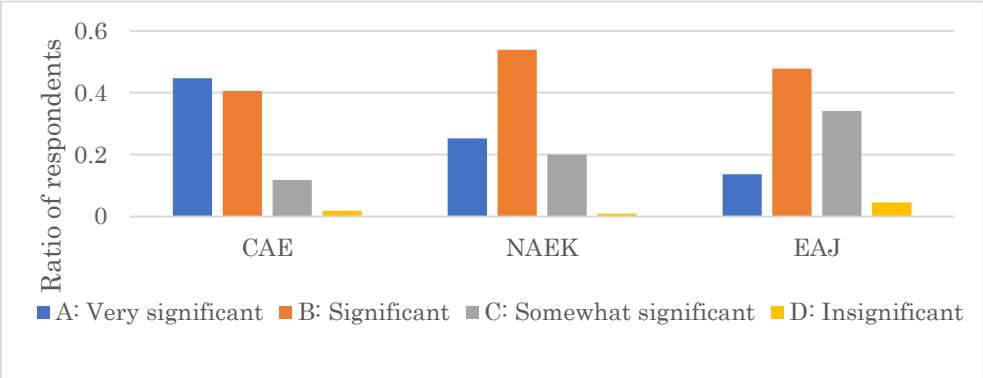
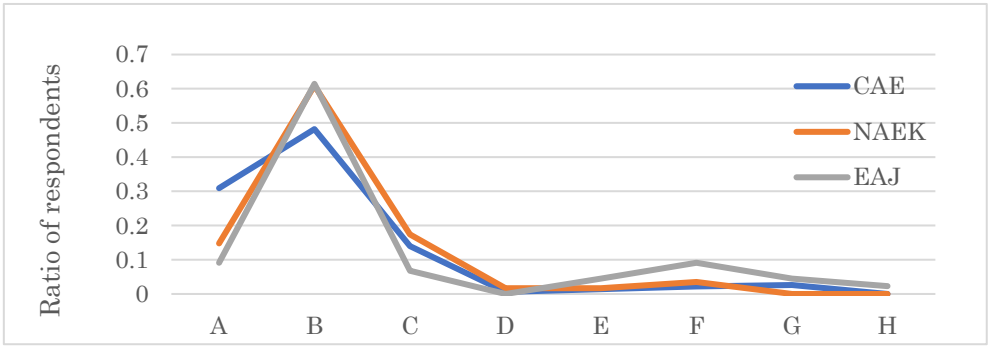


Fig. 8 Recognition on significance of collaboration in medical engineering field

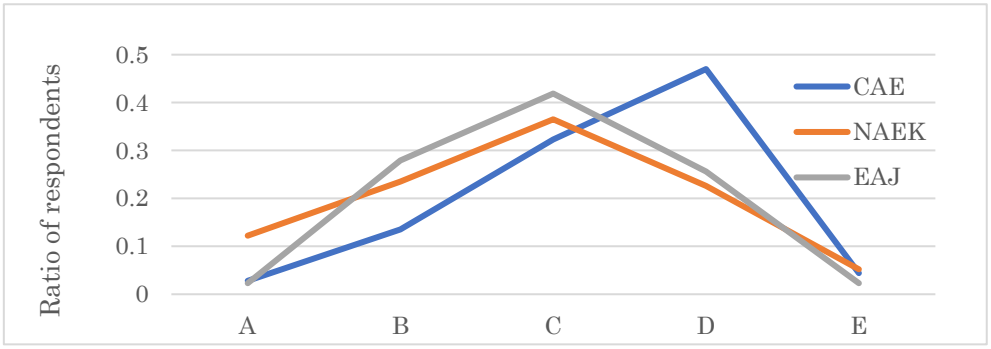
II-2.1 What is the most important issue for healthy-life span extension?



A. Healthcare Services, B. Health monitoring, C: Exercise promotion, D: Daily transportation, E: Social communication, F: Social/Human supports, G. Economical supports, H. Others

Fig.9 Recognition of the key factor for health-life extension

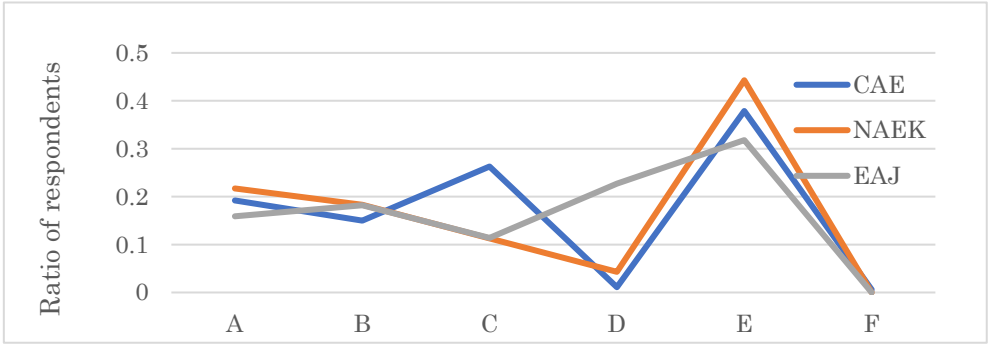
II-2.2 What is the satisfaction rating for elder population supports in your country?



A. 0-20% B. 20-40% C. 40-60% D. 60-80% E. 80-100%

Fig.10 Recognition on the satisfaction of elder population support

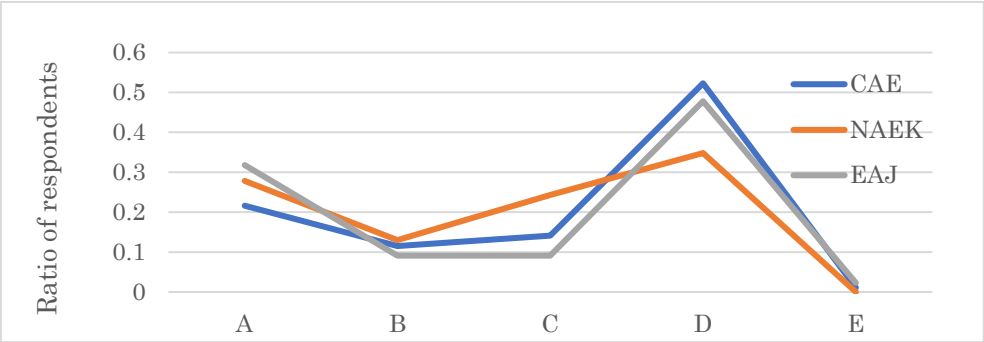
II-2.3 What is the most promising technology for elder population supports?



A. Robotic technologies, B. IT and communication technologies, C. Artificial intelligence analysis, D. Transportation systems, E. Social/Human resource management systems, F. Others

Fig.11 Recognition on the key technology for elder population supports

II-2.4 What is the most important issue of the engineering for elder population supports?



A. R&D activities, B. Education, C. Industrial Demand, D. Social Demand, E. Others

Fig.12 Recognition on the key issue in engineering for elder population supports

II-2.5. What do you think is the importance of the collaboration among Japan, China and Korea in elder population supports?

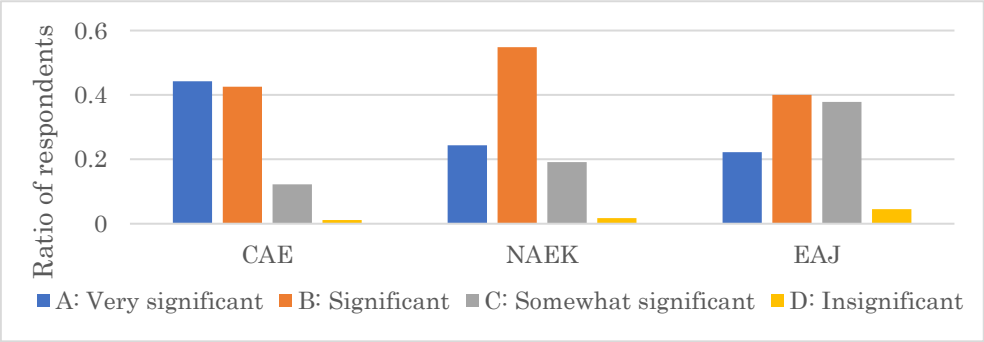
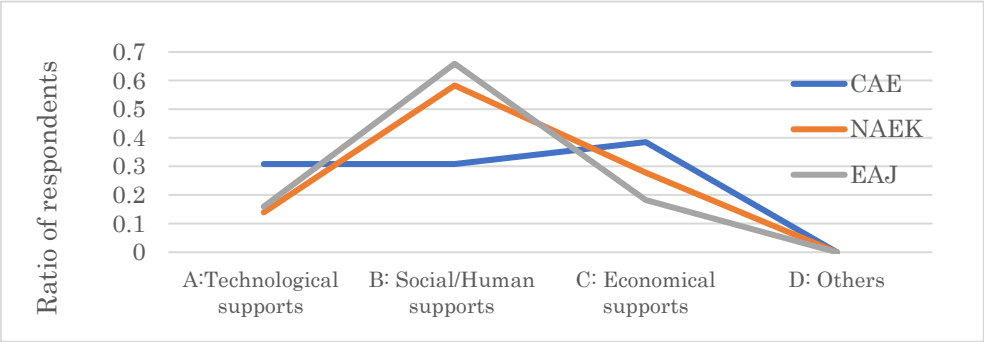


Fig. 13 Recognition on significance of collaboration in elder population supports

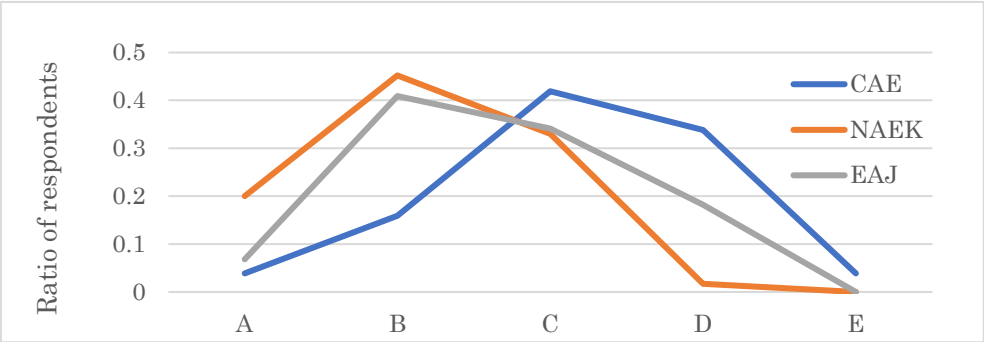
II-3.1 What is the most important issue in welfare supports?



A. Technological supports, B. Social/Human supports, C. Economical supports, D. Others

Fig.14 Recognition of the key factor for welfare supports

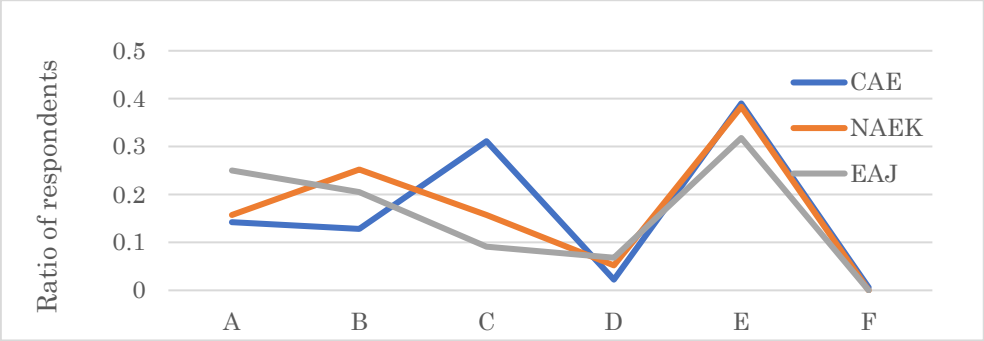
II-3.2 What is the level of popularization of engineering supports in welfare in your country?



A. 0-20% B. 20-40% C. 40-60% D. 60-80% E. 80-100%

Fig.15 Recognition on the popularization of engineering support in welfare

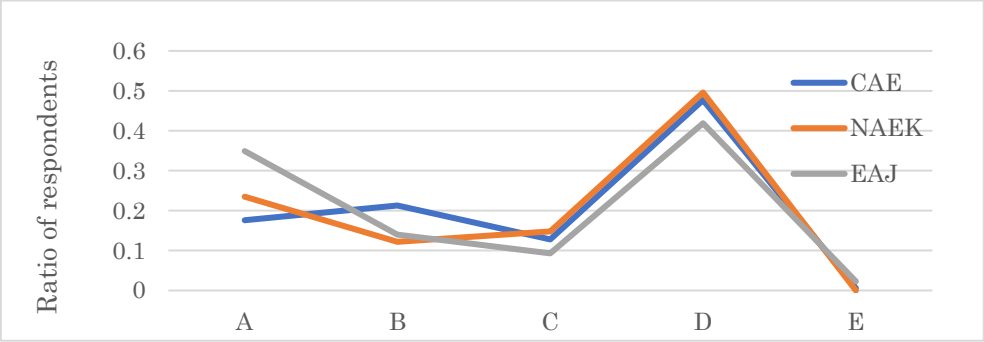
II-3.3 What is the most promising technology for welfare supports?



A. Robotic technologies, B. IT and communication technologies, C. Artificial intelligence analysis, D. Transportation systems, E. Social/Human resource management systems, F. Others

Fig.16 Recognition on the key technology for welfare supports

II-3.4 What is the most important issue to improve welfare engineering?



A. R&D activities, B. Education, C. Industrial Demand, D. Social Demand, E. Others

Fig.17 Recognition on the key issue in improvement of welfare engineering

II-3.5. What do you think is the importance of the collaboration among Japan, China and Korea in welfare engineering?

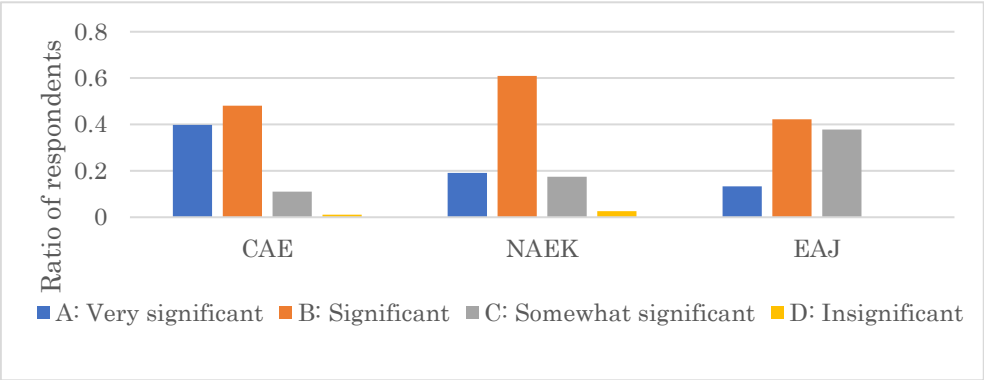


Fig. 18 Recognition on significance of collaboration in welfare engineering

Part 3: Personal information

1. Have you participated in some form of technological cooperation with Korea, China, or Japan during the last five years? If yes, how many times?

CAE:

Percentage of those who have experienced technological cooperation with Korea: 29.6%

Percentage of those who have experienced technological cooperation with Japan: 18.3%

Percentage of those who have experienced technological cooperation by 3 countries: 6.5%

NAEK:

Percentage of those who have experienced technological cooperation with China: 13.9%

Percentage of those who have experienced technological cooperation with Japan: 11.3%

Percentage of those who have experienced technological cooperation by 3 countries: 2.6%

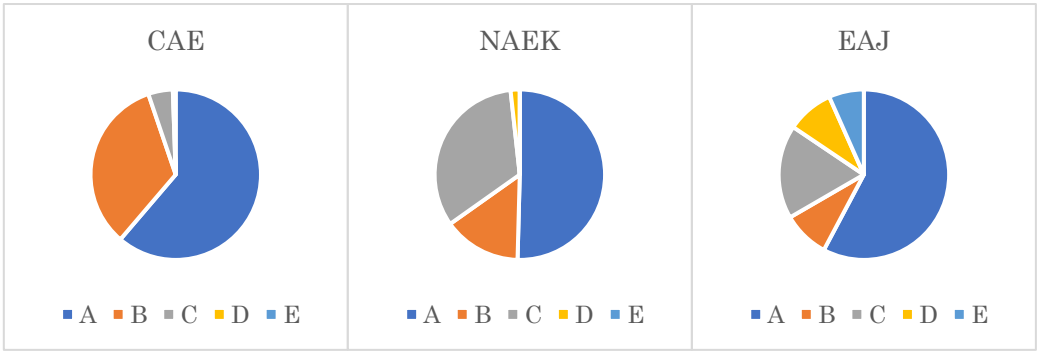
EAJ:

Percentage of those who have experienced technological cooperation with China: 43.5%

Percentage of those who have experienced technological cooperation with Korea: 26.1%

Percentage of those who have experienced technological cooperation by 3 countries: 13.0%

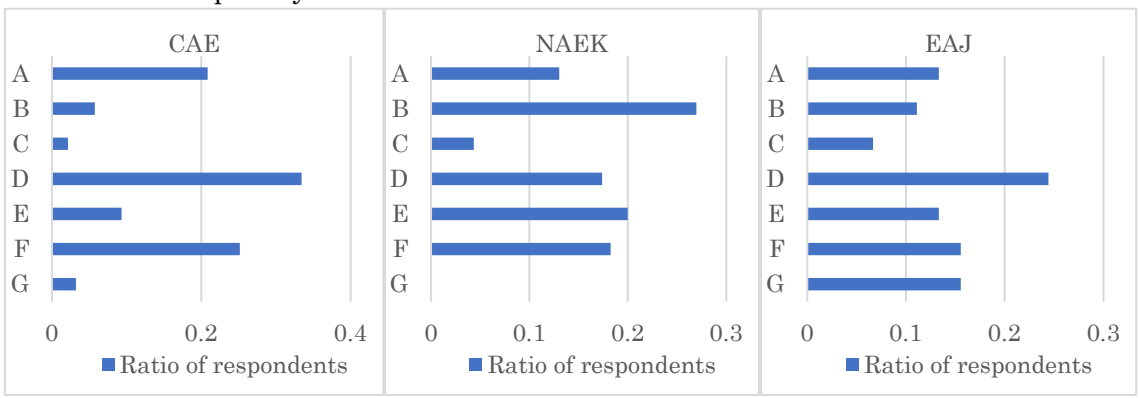
2. Your profession



A. Professor, B. Researcher. C. Business employer or employee, D. Government official or public sector employee, E. Other

Fig.19 Occupation of respondents

3. Your area of specialty



A. Civil and environmental engineering, B. Mechanical engineering, C. Technology management, D. Material and energy resource engineering, E. Electric/electronic engineering & ICT, F. Chemical and biomedical engineering, G. Other

Fig.20 Area of specialty of respondents

4. How long have you been engaged in your research field?

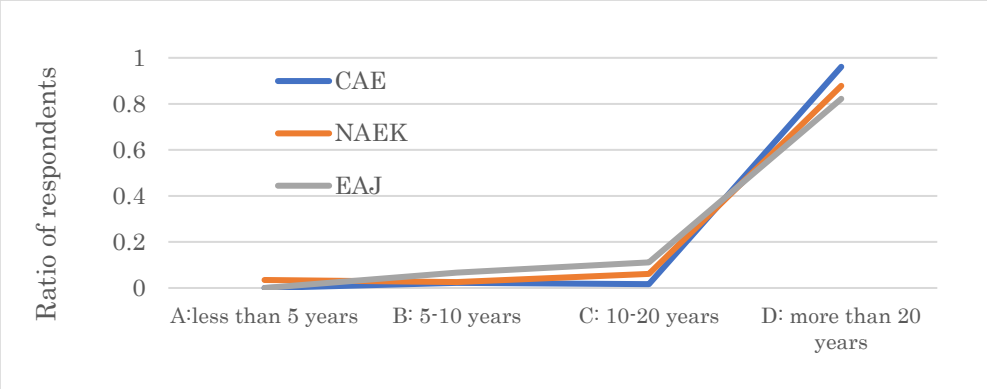


Fig.21 Experience in the research field

5. Respondents' age

Omitted

End of the survey summary