

Biomimetics for Human Well-Being and TEEB: State of science policy interface, patent applications and R&D

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The Economics of Ecosystem and Biodiversity (TEEB) was started from the year 2007 and the first internal report was published in COP9. In the framework of the TEEB, Monetary value of ecosystem services are evaluated. Ecosystem services are categorized into three services; regulating, provisioning, and cultural services. As a cultural service, inspiration from nature is evaluated. In this respect, Biomimetics can be regarded as a technology that is developed based on cultural services, and its development can contribute to sustainable management of ecosystem services and biodiversity, if biomimetics can facilitate understanding of ecosystem services and conserving ecosystems.

Regarding the economic potential of biomimetic technologies, biomimetics can be an attractive field of R&D. For example, investment in environmental and biomimetic technologies can increase R&D profits compared to conventional R&D projects (Managi et al., 2016). Biomimetics are expected to be introduced in Asia and developing regions where environmental conservation and appropriate management are needed to decrease the negative impacts of rapid development.

Biomimetics are becoming more salient worldwide as an innovative technology for holistic socio-ecological sustainability. Biomimetic technologies are inspired by natural resources and related knowledge for environmental managements (Ishida & Furukawa, 2013). In this context, social implementation of biomimetics can contribute to the management of biodiversity and ecosystem services. Moreover, biomimetic design can enhance the well-being of technology users (Fink, 2016).

Biomimetics can be applied to various scales including systems, organizations, processes, and products. The contributions of these factors to sustainable development should be emphasized because the original concept of biomimetics proposed in the 1950s and 1960s was not necessarily directly connected to sustainability but focused on technological issues. From an environmental perspective, biomimetics are insightful because natural systems and their structures do not depend on fossil fuels.

To facilitate the social implementation of biomimetics, which is developed based on biodiversity and ecosystems, an understanding of public perceptions of biomimetics is necessary (Kohsaka et al., 2017). Social values of the ecosystem in environmental management reflects public perceptions, and values influence people's judgement of and behaviour toward management and choice of technologies. To elaborate on the measures for enhancing the applicability of biomimetics to society, public perception needs to be considered, and the perceptions may influence people's technology choices.

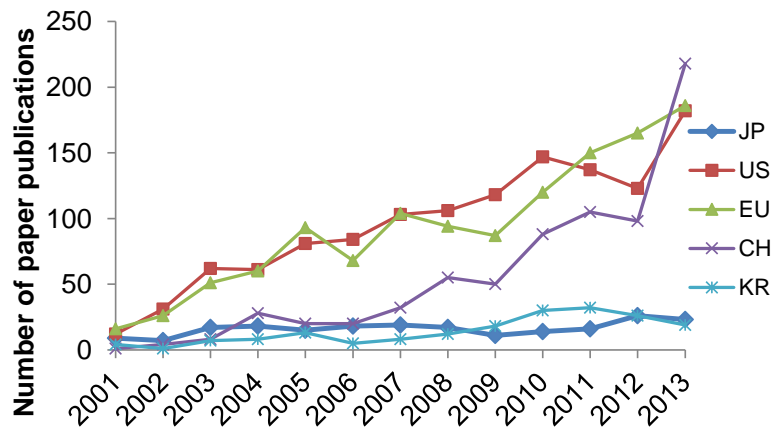


Figure 1. Number of paper publication related to biomimetics

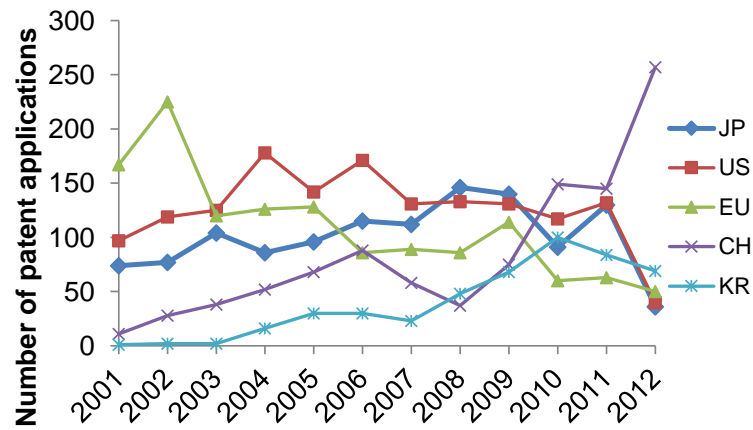


Figure 2. Number of patent application related to biomimetics

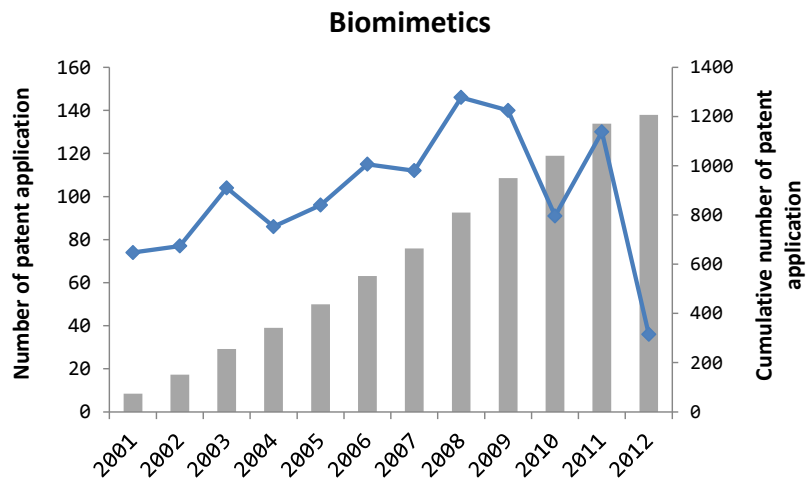


Figure 3. Cumulative number of patent application related to biomimetics in Japan

Considering the potential of biomimetics in conservation of biodiversity, we conducted comparisons between global trends of biomimetics and those of emerging

technologies by using data of number of patent applications and academic paper publications to identify the characteristics of biomimetics toward its social implementation. As results, higher ratio of paper publications to patent applications in biomimetics, agriculture technologies and AI was identified. Furthermore, high share of papers and patents of USA and EU, low share of paper publication of Japan, and high growth rate of papers and patents of China was identified (Figure 1, 2, 3). Patent applications and paper publications can be useful tools as objective benchmarks. For promoting social implementation involving technology users, the development of the platforms which connect the various stakeholders (e.g. engineer, biologist and etc.) is required. Stakeholders with different level of knowledge have different awareness of international trends such as ISO standardization (Figure 4). Knowledge and experience exchange between the stakeholders facilitates the social implementation.

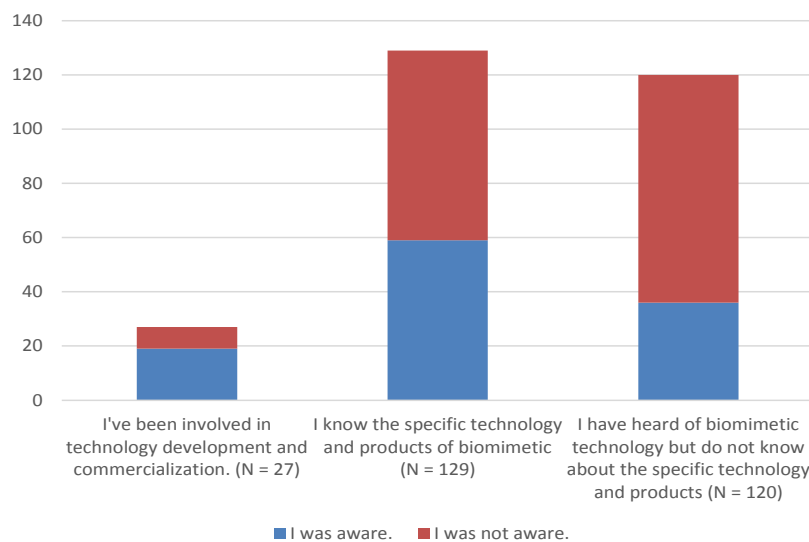


Figure 4. Awareness of ISO standardization of biomimetics and the level of knowledge of biomimetics (Respondents: Staff members of private companies in Japan)

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