

Creation-Development-Integration Research

Cycle and Grants-in-Aid

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I have in my hand a report entitled “Toward a New Research Paradigm.” The report was issued by a standing committee of the Science Council of Japan on 12 April 1999. The committee was chaired by Prof. Shun-ichi Iwasaki, a well-known inventor of the perpendicular magnetic recording system, which is employed in the recording units of virtually all of today’s hard disk drives manufactured around the world. The report mentioned that classifying research into basic research and the applied research distorts scientific progress, and proposed a new creation-development-integration model of research to replace the conventional basic and applied research model.

With this model, the research is classified into three stages—a creation model, development model and integration model—based on the process of carrying it out. It was Prof. Iwasaki’s discovery of the perpendicular magnetic recording method that gave him the impetus for creating this model. More details can be found on his Japanese homepage (<http://perpendicular.tohtech.ac.jp>). Shortly after I joined the Tohoku University faculty, I was able to attend a lecture delivered by Prof. Iwasaki on campus by fortuitous chance. I was so impressed by his model that classifies research into three cyclical stages, the last being the integration of knowledge gained into society, that I can vividly recall it even today. There are those who believe his model to be a research paradigm for fusing science and the humanities; however, I do not think this is necessarily its sum and substance. Rather, I understand the model to characterize the essence of scientific research: that is, it cannot be effectively advanced if subdivided.

My own research specialty is robotics. It covers a wide range of fields, including all research related to robots. I believe that artificial objects (artifacts) have no value unless they can be integrated into society in a way that has some meaning and usefulness to human beings. For me, therefore, the creation-development-integration

model masterfully expresses the process by which research should be advanced. I think it is a particularly important model for researchers working on such artifacts as robots. Recent years have seen vigorous research on artifacts used as scientific tools. I'm not altogether comfortable with this if the actual objective of the research is not something directly related to the artifact being developed but is rather the artifact itself. Nevertheless, I believe such research to be meaningful if the artifact developed is used with researchers in other fields to pioneer new realms of science.

Going back to my own research, I became interested in how to make robots move and act like humans. I have pursued this line in all the research I've undertaken, including multiple-robot coordination, human-robot coordination, robot helpers, and dance partner robots. Fortunately, I was able to receive Grants-in-Aid for several of these projects. Some are already at the stage of societal integration.

Though I often discuss such "integration" with other researchers, the word appears to be taboo when it comes to competing for research funding in Japan. Not considered to be either basic research or science, this kind of endeavor would appear to be pigeonholed into the category of applied research without any scientific merit. Therefore, it is often judged not to fit within the scope of scientific research funding systems in Japan. It's a shame that robotic research, which was seeded in Japan, is in many cases flowering more fully in other countries as a consequence.

A few years back, I served as a senior program officer in JSPS's Research Center for Science Systems, where I was given the opportunity to take a close look at the Grants-in-Aid system. I found it to be finely structured to scrupulously ensure fairness and impartiality, and created by the relentless efforts of related researchers and administrators. Even today, the system is being continuously improved. The high reputation enjoyed by the Grants-in-Aid program among Japan's various funding systems owes to the dedication of its precursors and all the others who have worked to design and enhance its operation.

Returning to the university faculty after my tenure at the Center ended, various things became evident to me. One was that everybody realizes the fact that Grants-in-Aid play an extremely large role in advancing scientific research. On the other hand, there are times when I cannot help but think that obtaining grants is in itself the purpose of research rather than the other way around. In other countries likewise, the funding

system can exert a strong influence on the way scientific research is implemented.

I was taken aback by an incident that recently came to my attention. I heard about it from of a young researcher who has done fascinating work attracting the attention of many researchers over recent years. His research being a new field, it was difficult for him to determine where it fit within the List of Categories, Areas, Disciplines and Research Fields of the Grant-in-Aid system. When seeking a new faculty post, he was asked in an interview where his research field fell within the List, causing him to become puzzled as to how to answer the question. While highly appraising the Grants-in-Aid program, I am afraid that letting the List of Categories, Areas, Disciplines and Research Fields take on a life of its own will exert unintentional influences on the advancement of scientific research in Japan. I pray that Grants-in-Aid will continue to contribute to the healthy and robust development of scientific research in Japan.