J. Tokyo Med. Univ., **58**(3) : 438～443, 2000

Session III: Needs for research, education, information and narrowing the science-policy gap

Filling the Gap between Research and Science Policy Analysis on the Difference and Countermeasures

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1. Introduction

For the promotion of the workplace health, it is important to bridge the gap between current knowledge and implementation of that knowledge[1]. In this bridging, the difference between research and policy is also an important issue. In the present study, to fill the gap between research and science policy, that addresses the perspective for implementation, analysis on the differences and countermeasures will be discussed. First, differences between research and policy cause communication gap between them are summarized. Then, the reasons why these differences emerge are analyzed based on the concept of "validation boundary". Finally, countermeasures to bridge the gap will be addressed from the knowledge-integration point of view as well as from the institutional point of view.

2. Difference between research and policy

What are differences between research and policy cause communication gap between them? These differences can be summarized as; 1) reality-shift, 2) working culture, 3) accountability, 4) time-horizon.[2] In dealing reality, framework based on theory is important for researchers. However, for policy-makers, practical problems are more important, therefore, they sometimes criticize the researcher's framework based on theory, since it has reduction and ignorance of some factors that are practically important. For working cultural aspect, policy-makers work based on the law, focusing on results, whereas researchers do not so concern the law, focusing research processes rather than results. Accountability is more required for policy-makers, rather than for researchers. As for the time-scale, researchers are likely to construct theories in long time scales, while policy-makers needs short-time results. Furthermore, policy is not made from single research, it is constructed from link of many researches. Policy-making is a goal seeking behaviour, and it needs value-oriented-decision. Scientists sometimes cannot help this "value-oriented-decision".

These are differences between research and policy. But why these difference emerge? We will analyze the answers towards this question in the next section.

3. Difference in "validation boundary" between research and implementation

3-1. Validation boundaries

In this section, the difference between research and policy is explained using the concept of "validation boundary". Scientific research is done and validated based on

Key words : research policy gap, validation boundary, bridge-work, intermediate-layer

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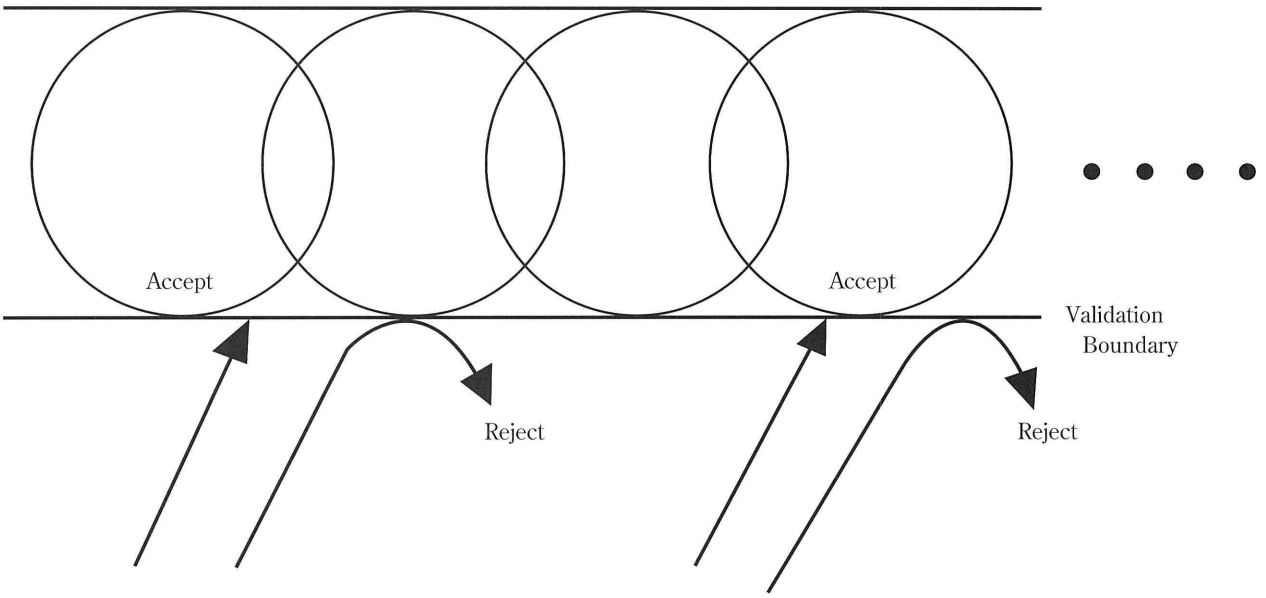

Fig. 1

refereeing system (peer review system), and this validated process is very important for the knowledge accumulation. Some papers are accepted and others are rejected in the refereeing process of specific scientific journal and this accepted-rejected-action construct the validation-boundary of knowledge production (Fig. 1)[3]. However, in policy-making process, who will "validate" the results of policy-making? There are no "validation boundary" as scientists have, and policy should be validated from "public" not through peer review. Furthermore, policy-makers are not interested in the validation process, but are interested in a goal-seeking behavior. Although some papers claimed the similarity between science and policy (e.g. PAST)[4], the validation boundaries (or knowledge criteria) between them are extremely different.

Based on the same reason, validation-boundary of current research and that of implementation, that is, validation-boundary for scientists and that for public, are different. A following example shows the difference of validation boundary of the most advanced research (papers in outstanding scientific journals) and that of the cite facing public. In the journal of *Internal Medicine*, Haynes[5] points out that one famous medical journal accepts papers that use questionable scientific methodology, including uncontrolled studies. He also points out that such problematic papers—being in their early stages and therefore not having undergone rigorous testing—are essential for communication among scientists; however, more rigorous testing and strictly controlled studies are needed for communication among clinicians, who encounter the public every day. This fact indicates that rigorous scientific methodology is more essential for communication at the boundary between science and society (i.e., the implementation) than at the publishing site (i.e., advanced research).

Thus, in this case, validation boundary for public is much rigorous than that for scientists, which show the "reverse tendency" rather than tendency ordinary expected. In this way, we should pay attention towards the difference between required criteria for research and that for implementation for public. The judgement of reviewers reflecting the validation of a paper is not the same as the validation boundary for the implementation. Furthermore, policy should aggregate these validation boundaries for implementation for public(see section 4–1 in this paper).

3-2. A model linking research system and policy system

Using this concept of validation boundary, principle of knowledge production in scientific community can be explained by following two systems; "quality control system through

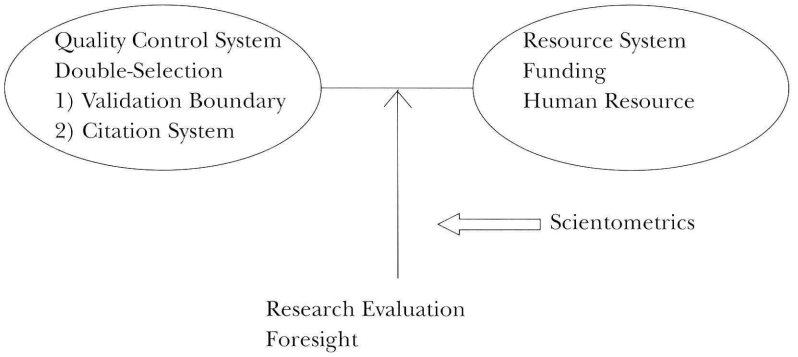

Fig. 2

validation boundary" (QC system) and "resource-allocating system" (RA system) (Fig. 2). These two systems are loosely coupling, but do not have strong connection. This connection is enhanced by policy-side, through activities of research evaluation and research foresight. Therefore, these activities from policy side determine the degree of coupling of these two systems in scientific community.

QC system has a double-selection system; one is "validation boundary" determined by referees' judgement on acceptance of publication, and the other is "citation system". The citation system, that is, the citation network, can be defined as a chain of citation in which each paper is a component of the system. Each component leads to the production of the next one (i.e., the next paper)—that is, each component produces the next one, through operation of the system. The citation system operates continuously, each operation (citation) producing the next operation (citation). These citation networks continuously re-position the papers. The citation, used as a compass, contributing to knowledge accumulation[6]. Figure 3 explains the change process of positioning papers, legitimating papers, and frequently cited papers, according to the observation point. In this citation system, frequently cited papers are considered as legitimated papers. Therefore, citation process plays an important role in the legitimization of the knowledge.

This double selection system (validation boundary and citation system) is playing an essential role in QC system. Moreover, in this knowledge production of scientific research, the producer of the knowledge, and the consumer of the knowledge are both scientists. Both producer and consumer belong to the same community (scientific enterprise). The judgement by peers reviewing, which construct validation boundary, are all done by scientists. Furthermore, citing is also done mainly by scientists. However, in commodity production (not in knowledge production), the producer and consumer are independent and the law of demand and supply in economics decides the interaction between producer and consumer. Based on this law, quantity and prices of products are determined. However, in knowledge production, quantity and prices of products (that is, scientific papers) are determined by the above double selection system; validation boundary and citation system, and this determination is internally closed within scientific community.

Therefore, in knowledge production, the market rule does not play a role. On the contrary, a different principle is on going. Fig. 2 is a model for this knowledge production principle. In this model, QC system is maintained by scientific community. RA system, that includes funding system and human resource allocating system, is the system that can affect on the QC system. In the Mertonians' view (in classic sociology of the sciences), this RA system is also controlled by QC system, representing the "autonomy" of the scientists. However, in the modern society, QC system and RA system are independent, and the connection of these two systems are intermediated by policies, through activities of "research evaluation"[7] and "research foresight". Therefore, these activities from policy side determine the degree of coupling of these two systems in scientific community. Scientometrics, that is a field to conduct a quantitative analysis on the scientific activities, including publication share analysis as well as citation frequency

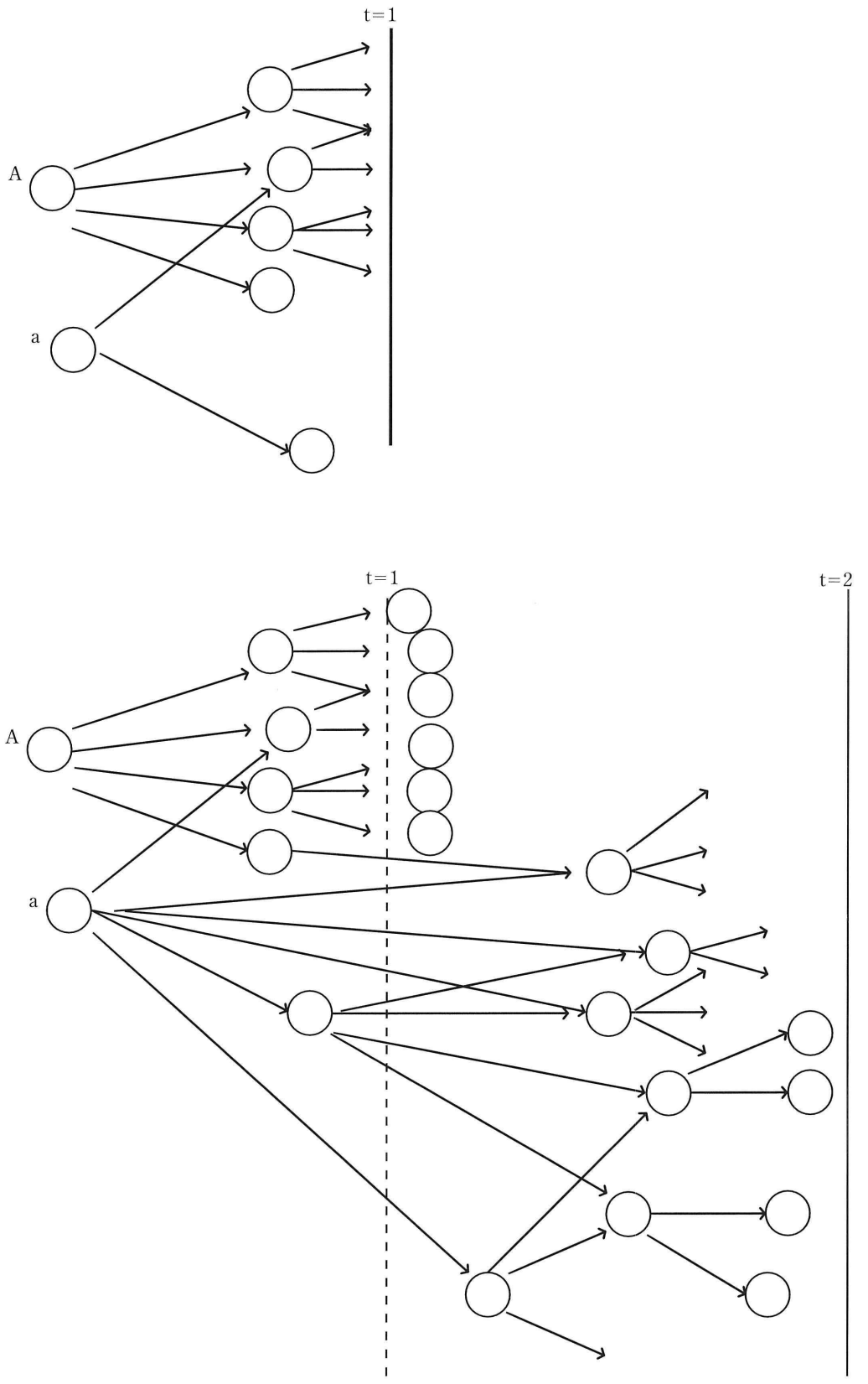

Fig. 3 The Change Process of Positioning Papers, Legitimating Papers, and Frequently Cited Papers, according to the Observation Point

At t = 1, <A> paper is a frequently cited, legitimated paper.

At t = 2, <a> paper is a frequently cited, legitimated paper.

measurement	*sensitive-time-period*	*sensitivity*	*suitable-task*
psychological method			
NIOSH, JCQ	week/month	cumulative	general
:			
physiological method			
Heart-rate-variability	second/min	instantaneous	task of pilot air traffic control driving task
:			:
biochemical method	hours/days	:	

Fig. 4 Example of Knowledge Integratirn synthesis

analysis, are considered as a tool for this intermediation.

4. Countermeasures

For bridging the gap between validation boundaries at the scientific knowledge production and those of implementation, we can consider two countermeasures, one is knowledge integration point of view that address linking different validation boundaries and the other is the institutional point of view.

4-1. Linking validation boundaries

For linking validation boundaries, we first consider "synthesis", rather than "analysis". Analysis can be done based on one-specific validation boundary, whereas synthesis requires classification and integration of validation boundaries to address suggestion or future plans. For classification and integration of validation boundaries, it is useful to construct tables that aggregate the characteristics of methodology[8), 9)]. One example of these tables are shown in Figure 4. This figure summarizes the characteristics of measurement for the occupational stress research, and items for classification reflects the validation boundaries on which measurements are based.

Using this table, we can know the strength, weakness, and application-rage of each measurement. More concretely, it shows application target (for individual or for collective), sensitivity in time period, suitable disease phase, and sensitivity for factor finding of each measurement. These syntheses through the table help making the guidelines to decide the suitable measurements or counter-measurements for each work-site, which has specific characteristics. This kind of table also can be utilized when we make guidelines for consensus meeting in public. (For example, guidelines for environment pollution, guidelines for accountability of medical treatment., etc.)

For this kind of linking validation-boundaries, Mode 2 knowledge production[10)], that is produced in "application context" is required. In this transdisciplinary knowledge production, it is important to seek optimum solution in given boundary conditions in the limited time. The above kind of table, that reflects the summarization of validation boundaries, can be utilized in this Mode 2 knowledge production, that is, making suggestions, proposals, and future plans.

4-2. Linking institutional gaps: intermediate layer

Bridging different validation boundaries can be called as "bridge work"[11)]. Who will play a role in this bridge work? To answer this question, the concept of "intermediate layer"[12)] is useful. Intermediate layer is a group of institutes that mediate the administrative level (national government) and research performance level (research institutes, research groups, and researchers). This layer includes research councils, funding agencies, advisory councils, and associations of universities. Beyond from the Rip's definition, it is also considered that unions of citizens, practitioners' union, and also the international unions (e.g. Triangular meeting for the Tokyo Declaration on Work-Related Stress and Health in Three Post-Industrial Settings—EU, Japan, and USA) can play a role as the intermediate layer that bridge the administration level and research execution level. Therefore, to bridge the gap

between the current research and implementation, this kind of intermediate layer, unions of spontaneous international groups activities are anticipated.

5. Conclusion

To explain the differences between research and policy, the concept of "validation boundary" are utilized in the theoretical point of view. The model for linking research system and policy system can be constructed from quality-control system using validation boundary (QC system), and resource allocating system (RA system). The characteristics in knowledge production can be analyzed in this model, in the contrast of the market rule. Furthermore, the countermeasures for linking the different validation boundaries, "bridge-work" using tables aggregating the different validation boundaries are introduced. Finally, for the subjects who conduct this bridge-work, intermediate layer that mediate between administrative level and research performance level is discussed.

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