0.3 Evidence in policy-making and the “science of science, technology, and innovation policy”

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Abstract

The need for evidence-based policymaking has long been called for, and moves toward its institutionalization are rapidly gaining a foothold in Japan. However, numerous issues still need to be addressed. After presenting an overview of what evidence in policy formation is, I introduce the history of why a “science of science, technology, and innovation policy” is necessary and its characteristics.

Keywords

Evidence; science of science, technology, and innovation policy; coevolution

1 Introduction

Section 0.1 outlined how the positioning and quality of science, technology, and innovation are changing, as are policy frameworks, including the target, scope, and purpose of science, technology, and innovation policy. In fact, in the Fourth Science and Technology Basic Plan enacted in 2011, the framework was expanded from the conventional R&D-centered science and technology policy to science and technology innovation policy that promotes science, technology, and innovation in an integrated manner. Meanwhile, in 2014, the Council for Science and Technology Policy (CSTP) was reorganized into the Council for Science, Technology and Innovation (CSTI).

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In June 2020, the Basic Act on Science and Technology was revised and renamed the Basic Act on Science, Technology, and Innovation, with the promotion of the humanities and social sciences and generating innovation added as matters to be promoted through the Act.[2] In line with this, the 6th Basic Plan, which took effect from April 2021, was enacted as the Science, Technology and Innovation Basic Plan.[3] The revised plan clarifies that the goal of science, technology, and innovation policy is to contribute to "integrated knowledge" through the fusion of knowledge from both the humanities and social sciences and the natural sciences to generate social value.

Meanwhile, the importance of evidence in policy formation has also been recognized. In the field of science and technology innovation policy, the Fourth Science and Technology Basic Plan, launched in 2011, proposed the following:[4]

> The Japanese government will promote "Science of Science, Technology and Innovation Policy" and promote the formation of policy based on objective evidence, evaluation, and reflection of the results of verification in policies, and establish a process to evaluate the preconditions for policies and reflect them in policy planning. In so doing, we will promote the development of human resources involved in policy formation, with the participation of not only researchers in the natural sciences but those in the humanities and social sciences.

Amidst this momentum, the Science for REdesigning Science, Technology and Innovation Policy (SciREX) Project was launched in 2011. The project intends to facilitate the co-evolution of science and policy and the establishment of "science for science, technology and innovation policy" as an interdisciplinary research field through human resource development and network formation, data and information infrastructure construction, and open research and development (Japan Science and Technology Agency, Research and Development Strategy Center, 2011a).

Launched in 2016, the Fifth Science and Technology Basic Plan[5] went further than its predecessor, setting key indicators and targets[6] in order to monitor the results and progress of the policy nationwide. Incidentally, the term "objective evidence" is used in the Fifth Plan. The Cabinet Office has also gathered evidence on research, education, and fund acquisition at universities and other research institutions, developed various analytic functions, and established the e-CSTI (evidence data platform constructed by the Council for Science, Technology and Innovation) as a platform sharing analytic functions and data with relevant ministries and agencies, national universities, and research and development corporations, which was opened to the public in September 2020.[7]

2 https://www8.cao.go.jp/cstp/cst/kihonhou/mokuji.html

3 https://www8.cao.go.jp/cstp/kihonkeikaku/index6.html

4 https://www8.cao.go.jp/cstp/kihonkeikaku/index5.html

5 https://www8.cao.go.jp/cstp/kihonkeikaku/index4.html

6 https://www8.cao.go.jp/cstp/kihonkeikaku/5sanko.pdf

7 https://e-csti.go.jp/

Commencing in FY2021, the Sixth Science, Technology and Innovation Basic Plan proposes that systematic, evidence-based, and consistent planning should be carried out; that evidence-based national strategies should be formulated and promoted; that objective evidence-based policymaking (EPBM) should be thoroughly implemented in science, technology, and innovation administration; and that all relevant ministries and agencies should carry out evidence-based policymaking by FY2023.[8]

The government as a whole also has a policy of building momentum for EBPM. While EBPM has been widespread in Europe and the US since the end of the 1990s,[9] in Japan, the term "evidence" has only been used in the "Basic Policy for Economic and Fiscal Management and Reform" since 2013. In 2017, the Japanese government announced its policy to promote EBPM.

In addition, the 2014 statistical reform—that is, the fundamental reform of official statistics—clearly positioned official statistics as the foundation supporting EBPM. In accordance with the Basic Act on the Advancement of Public and Private Sector Data Utilization (2016), the EBPM Promotion Committee was established as an organization responsible for cross-governmental EBPM functions. From 2018, EBPM promotion officials (i.e., Deputy Director-General for Policy Planning or Policy Planning Counselor) were placed within each government ministry.

Although it is a significant development that the Japanese government has developed an understanding of the importance of EBPM and established a system, many issues need to be addressed. For instance, there is confusion surrounding what constitutes evidence in policy formation and a shortage of data and human resources who can take charge of EBPM. As such, it is far from overnight change.[10] In addition to surveying the current level of penetration of EBPM within the government and identifying issues, the EBPM Promotion Committee is preparing a roadmap for the future direction of EBPM from the perspective of spurring the adoption of EBPM, quality improvements, and securing, nurturing, and utilizing human resources.[11]

The target of the SciREX project since its inception, evidence-based policy formation is broader in scope than current EBPM and mainly focuses on the use of logic models and strengthening administrative reviews within the government, as well as broader-scoped medium- to long-term efforts to build human resources, communities, and networks as a foundation. While not necessarily linked to movements within the government, evidence-based policy formation can be regarded as part of a major trend toward EBPM.

However, such efforts to bring scientific rationale and objectivity into policy formation have been made many times in the past. It has also been pointed out that many challenges still need to be overcome and numerous gaps between ideals and reality still need to be filled. In other words, the accumulation of research relevant in each instance is not directly used in policy formation. The existence of gaps between the science of policy and policy formation, such as the lack of progress in knowledge transfer, is partly due to the low

8 https://www8.cao.go.jp/cstp/kihonkeikaku/index6.html

9 Kanemoto, Yoshitsugu (2020), and others have introduced examples from other countries.

10 The characteristics and issues of EBPM in Japan are summarized in Yoshitsugu Kanemoto (2020), Yohei Kobayashi (2020), and National Diet Library (2020), among others.

11 Summary of EBPM Study Working Group, EBPM Promotion Committee (June 2021)
https://www.kantei.go.jp/ jp/singi/it2/ebpm/dai7/siryou1-1.pdf

mobility of human resources between government and academia, the reliance on inside knowledge, and the use of policy research results in the habits surrounding policy formation. There is a need to design institutional functions to address these gaps.

Following an overview of what constitutes evidence in policy formation, I present a history of why a "science of science, technology, and innovation policy" is needed and its characteristics.

2 What is evidence in policymaking?

The term ebidensu ni motodzuku seisaku keisei can be translated as evidence-based policymaking or evidence-informed policymaking. Efforts to formulate evidence-based policy were pioneered internationally in healthcare policy, and have since been expanded to include education policy, development assistance policy, and other social policies in general. Moreover, efforts are being made to collect and systematize relevant evidence through systematic reviews (i.e., a series of processes comprising the formulation of issues, collection of research, meta-analysis, and reporting), such as the Cochrane Collaboration in the field of health policy and the Campbell Collaboration in the fields of social and educational policy.

The concept of evidence level, which classifies the quality of evidence according to how the evidence was generated, including its reliability and bias, has mainly been introduced in the medical field.

To start with, what is evidence? In Japanese, the terms ebidensu (evidence), konkyo (rationale), shoko (evidence), kakkanteki konkyo (objective evidence), and kagakutekikonkyo (scientific evidence) are all used. Clearly, there are multiple definitions of evidence, with the term used in multiple senses. For example,

- Evidence is a fact or phenomenon that has a scientific basis, that is, it is a fact or event that has been objectively observed based on a logical system or the like. It is not only quantitative in scope, but qualitative. The evidence necessary for science and technology innovation policy formation is, for example, related to the structure and dynamism of the economy and society, apparent and latent issues in society, social expectations for science and technology, and the current state of and potential for science and technology (Center for Research and Development Strategy, Japan Science and Technology Agency,2011a).
- Evidence is the systematic facts and information available about whether certain beliefs and claims are true (Evidence Collaborative: http://www.evidencecollaborative.org/).
- Scientific evidence forms the basis of an argument supported by information generated according to a single, formal process (Gluckman, 2016).
- Evidence is not just data, but causal relationships between a policy (A) and an outcome (B).[12]

This ambiguity tends to confuse discussions because it ranges from cases where the term is treated as synonymous with data or indicators to those where the quality of evidence is strictly questioned. As the applicability of social experiments and other methodologies varies depending on the nature of what the

12 http://home.uchicago.edu/ito/pdf/RIETI_BBL_2016_1025_Ito_Final.pdf

policy is targeting, the methods by which evidence is obtained and what is defined as evidence (e.g., whether qualitative evidence is included or not) varies across policy fields. The range of application in policy formation practice also differs because of differences in the extent of uncertainty of targets (Center for Research and Development Strategy, Japan Science and Technology Agency, 2011a).

As the possibilities for experiments to generate evidence and the complexity of defining a "question" and its scope differ significantly depending on the field, there are many challenges in adapting a strict definition of evidence to social science fields and policies, and further research and validation will likely be required. Beyond discussions of the rigor, robustness and/or generality of research, the challenge for the future is how to define and share practical evidence in STI policy.

3 What is the "science of science, technology, and innovation policy"?

3.1 Background

Why has the need for a "science of science, technology, and innovation policy" arisen? I would like to look back at the discussions in 2011, when the SciREX project was launched.[13] One of the reasons behind the launch of this project was the growing expectations in countries around the world for the realization of innovation as a basis for medium- to long-term international competitive strength, as well as for solving issues in society. Amidst rapid structural changes in population and society, and the increasing complexity of the global economy and society, governments aimed to promote science and technology and generate innovation while simultaneously facing challenging financial circumstances. To this end, there was a need for evidence to demonstrate how policies effectively contributed to efficiency. As a precondition for these efforts, governments, regardless of policy area, were increasingly required to ensure transparency in policy formation and to be accountable to society through evidence. In terms of public participation in policy formation, new methods of policy formation are being explored, and it is necessary to ensure access to evidence in this process as well. The need to address these issues has raised expectations for a "science of policy" in general. Expectations for the possibility of a "science of policy" were further raised by big data analysis and the visualization of information achieved through information engineering, as well as the possibility of social experiments based on the development of social science fields as empirical and experimental sciences. The growing emphasis on open access, not only to science but to administrative data, has provided a tailwind for a "science of policy."

The fact that efforts concerning a "science of science, technology, and innovation policy" were being promoted in Europe and the US had a significant impact on Japan. In the US, the impetus came in 2005, when Marburger, the former Director of the US Office of Science and Technology Policy and Science Advisor to the President, raised the need to build a community of practice to generate the data, tools, and

13 Center for Research and Development Strategy, Japan Science and Technology Agency (2011a), National Graduate Institute for Policy Studies (2014), Okamura Asako (2013), and so on.

methodologies needed to support policymakers in science policy decision-making.[14] An interagency task group was subsequently established and the Science of Science and Innovation Policy (SciSIP), a program to promote academic research, was launched by the National Science Foundation (NSF) in 2007. The Science of Science Policy: A Federal Research Roadmap[15] was published in 2008, and a handbook in 2011 (Fealing et al., 2011). Subsequently, in 2019, in response to changes in the NSF program, the SciSIP program was renamed the Science of Science: Discovery, Communication, and Impact (SoS:DCI) program.[16] Similar flagship initiatives were undertaken in Europe, but in the form of longstanding research grant programs related to science and technology policy research and innovation research, primarily in the EU, as well as strong researcher communities and networks. Efforts were also made to build a shared data infrastructure.[17]

Observing the leading efforts in these countries at the time, and assuming issues shared by all countries—including increasing demands for accountability, streamlining the use of public funds due to financial constraints, and responding to social issues—it was the realization of senior policymakers that evidence that could be used in policy formation was not readily available that led to the start of funding and other programs to promote relevant research. The need for collaboration among various academic disciplines and the creation of mechanisms linking science and policy were recognized in all of the initiatives.

What are the characteristics of the "science of science, technology, and innovation policy" anticipated in this process? Key points are provided hereunder.

3.2 Policy for science and science for policy

"Science of Science, Technology, and Innovation Policy" is an initiative that encompasses both policy for science and science for policy. At the same time, policy formation itself needs to evolve and become more sophisticated; science for policy is needed to support this. In doing so, it is important to consider not only the creation and accumulation of hard evidence (e.g., the accumulation of data and tools), as the debates that have embroiled society surrounding the Great East Japan earthquake and the ongoing COVID-19 pandemic have once again made clear, it is important to go further and consider the role of evidence in policy formation and creating social consensus.

3.3 Cooperation between diverse academic disciplines

By integrating knowledge from various natural sciences and the humanities and social sciences, while utilizing the results of past research on science and technology policy and innovation research, the "Science

14 For US trends, see Center for Research and Development Strategy, Japan Science and Technology Agency (2019).

15 National Science and Technology Council (US); Subcommittee on Social, Behavioral, and Economic Sciences (2008).

16 https://www.nsf.gov/pubs/2020/nsf20128/nsf20128.jsp and https://beta.nsf.gov/funding/ opportunities/science-science-discovery-communication-and-impact-sosdci

17 https://www.mext.go.jp/b_menu/shingi/chousa/gijyutu/025/shiryo/__icsFiles/afieldfile/2017/

of Science, Technology, and Innovation Policy" is expected to facilitate the formation of a new field of research.

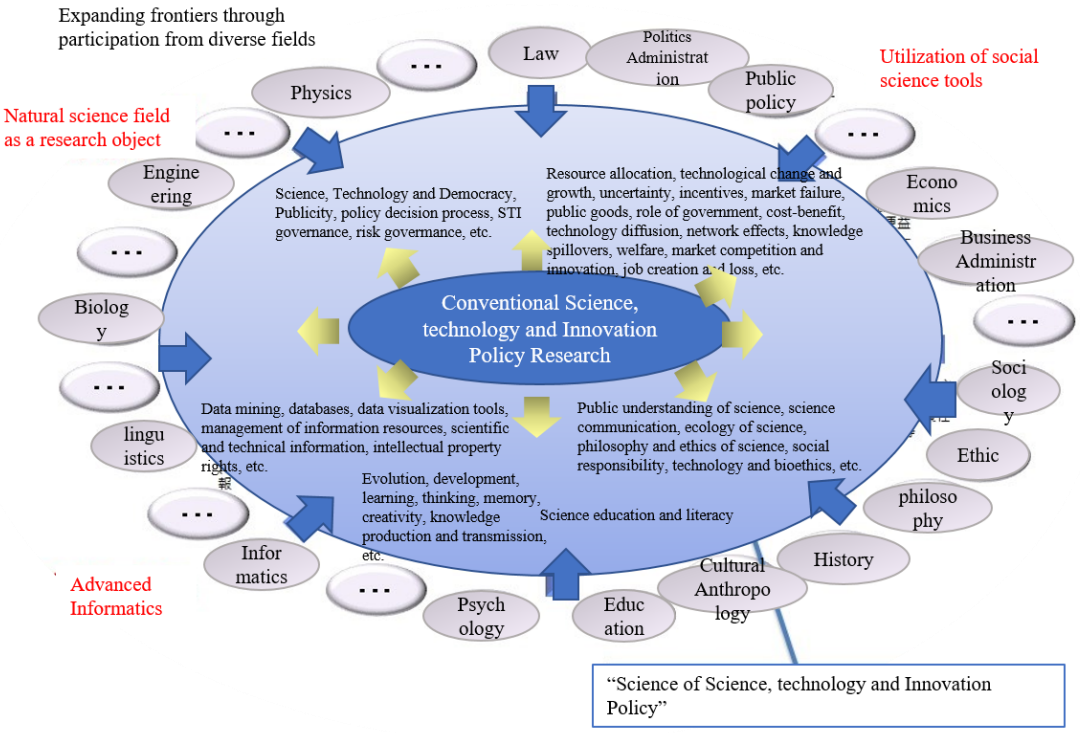

Figure 1. The development of "Science of Science, Technology, and Innovation Policy" through collaboration between various academic disciplines
Source: Center for Research and Development Strategy, Japan Science and Technology Agency (2011a)

Expertise in each of the natural science disciplines is essential to accurately grasp the current state of the scientific and technological fields and foresee latent future potential. At the same time, knowledge of the humanities and social sciences is essential to understanding the structure of the real economy and society in an integrated and cross-sectional manner, and the relationship between the economy, society, and policy and science and technology in a sophisticated manner. As such, the importance of creating a "science of science, technology, and innovation" that links the knowledge of the natural sciences and the humanities and social sciences is steadily increasing.

This raises the question: what kind of research is needed? Research and Technology Planning ("Science of Science and Technology Innovation Policy" Special Issue, Vol. 27 [2013], No.3/4 and Vol. 28 [1]) summarizes trends in science and technology policy and innovation policy research, and what contributions can be expected from economics, business administration, sociology, legal and political science, informatics, and public policy studies.[18]

18 https://www.jstage.jst.go.jp/browse/jsrpim/28/1/_contents/-char/ja and https://www.jstage.jst.go.jp/browse/jsrpim/27/0/_contents/-char/ja

The SciREX project has been working to identify what kind of interdisciplinary field the “science of science, technology, and innovation policy” will develop into, identify important questions (i.e., scientific questions) related to research and policy, and provide a top-down view and structure for the entire research field. [19] In this respect, “Science of Science, Technology and Innovation Policy” Core Content (https://scirex-core.grips.ac.jp/) provides an overview of the components on this basis.

The core content covers the following topics:

- Science and technology innovation dynamics.
- The science and technology innovation governance and policy formation process.
- Science and technology innovation and society.
- Socioeconomic impact assessment of science and technology innovation policies.
- History and overseas information on science and technology innovation policy.

3.4 Analysis, design, and implementation

The results of research in the field of “science of science, technology, and innovation policy” are expected to be used in policy formation and in practice within society, eventually resulting in the evolution of new mechanisms for policy formation. However, it is rare that the results of individual studies can be directly used in policy formation in practice.

First, there is a need to make available research that contributes to policy formation by taking a bird’s-eye and structural view of apparent and latent policy issues in science technology and innovation policy. One way to achieve this is for the policy and research sides to collaborate in setting the research agenda. In SciREX project’s Program for Achieving Joint Development,[20] policymakers and researchers are engaged in dialog to establish research topics based on specific policy issues and conduct research together. This is expected to be an EBPM practice in which both parties work together from the problem-setting stage.

Second, it is important that the results of research obtained from individual studies are structured as a body of knowledge that can be readily utilized in policy formation. One way to do this would be to conduct a meta-analysis in which the results of multiple individual studies are collected, aggregated, evaluated, and integrated based on set criteria.[21]

19 The history of the discussion is summarized in Center for Research and Development Strategy, Japan Science and Technology Agency (2011b) and Center for Research and Development Strategy, Japan Science and Technology Agency (2017).

20 https://scirex.grips.ac.jp/project/list.html

21 A meta-analysis of relevant research in innovation policy conducted by MIoIR at the University of Manchester is a case in point, see: http://www.innovation-policy.org.uk/compendium/

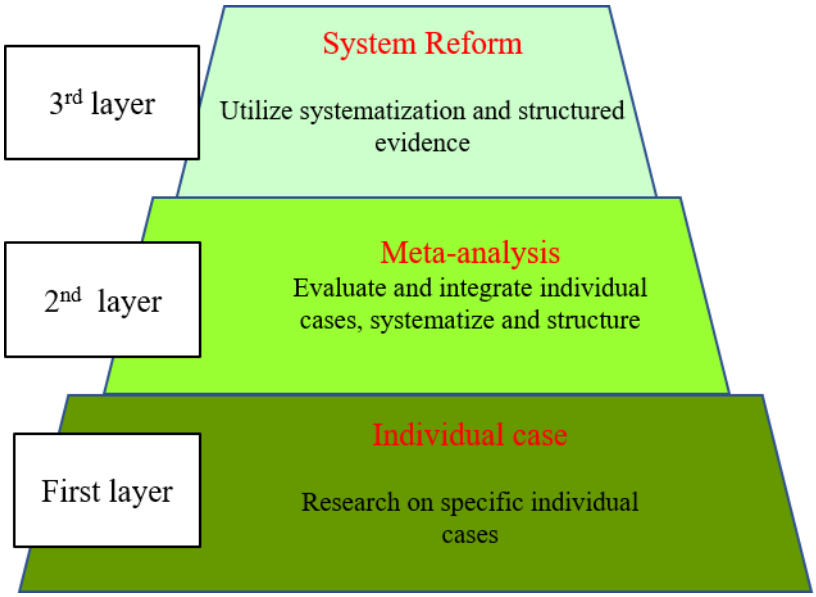

Figure 2. Structuring individual research into a knowledge system that can be readily used for policymaking. Source: Center for Research and Development Strategy, Japan Science and Technology Agency (2011a)

However, these measures alone are insufficient. A process for using evidence at appropriate junctures during policy formation is required, with full recognition of issues like the uncertainty and incompleteness of evidence. There are several patterns of evidence-use in policy formation. In one, policymakers and decision-makers refer directly to research findings that may give rise to new systems or the update of ineffective ones. Alternatively, in the case of highly impactful research findings, they may enlighten society in general, and thus encourage people to change their perceptions and behaviors. One possible consequence may be changes to policy and systems. There may be a need to strengthen the various potential paths linking research and policy.

At the same time, there is a need to enhance the understanding and change the mindsets of policymakers and society at large in respect to the use of evidence in policy-making, including its limitations. The concept of "evidence" and its necessity have been recognized by policymakers and by society since the latter half of the 2010s. Although there are many practical difficulties and challenges, significant progress is expected to be made going forward.

References

Fealing, K. H., Lane, J. I., Marburger, III, J. H., and Shipp, S. S., editors (2011). The Science of Science Policy: A Handbook. Stanford University Press.
http://www.sup.org/books/title/?id=18746

Gluckman, S. (2016). Science advice to governments: An international perspective. 82nd GIST. November 7, 2016, Seminar presentation material.

National Science and Technology Council (US). Subcommittee on Social, Behavioral, and Economic Sciences. (2008). The Science of Science Policy: A Federal Research Roadmap. NSTC. https://permanent.fdlp.gov/lps115579/39924_PDF%2520Proof.pdf

Okamura, A. (2013) “Kagaku gijutsu innobeshon seisaku no kagaku” no kousei ni mukete. [The construction of the “Science of Science, Technology, and Innovation Policy”]. Research and Technology Plan, Special Issue: The Science of Science and Technology Innovation Policy, 27 (3/4):144–155 https://doi.org/10.20801/jsrpim.27.3_4_144 [In Japanese]

Okamura A., Shineha R., Nozawa S., Hara Y., Fukaya K., and Kobayashi S. (2013). Aspects of science and technology innovation policy research. Research Technology Plan, Special Issue: The Science of Science and Technology Innovation Policy, 28 (1): 9–22. https://doi.org/10.20801/jsrpim.28.1_9 [In Japanese]

JST/CRDS (2011a). Ebidensu ni motozuku seisaku kousei no tame no “kagaku gijutsu innobeshon seisaku no kagaku” [Construction of “Science of Science, Technology, and Innovation Policy” for Evidence-Based Policy-making], Strategic Recommendation CRDS-FY2010-SP-13, Research and Development Centre, Japan Science and Technology Agency (JST). https://www.jst.go.jp/crds/pdf/2010/SP/ CRDS-FY2010-SP-13.pdf [In Japanese]

JST/CRDS (2011b) “Kagaku gijutsu innobeshon seisaku no kagaku” no fukan kouzouka ni muketa kentou. [A study toward an overview and structuring of the “Science of Science, Technology, and Innovation Policy”]. Waakushoppu houkokusho [Workshop report] CRDS-FY2011-WR-13, Strategic Center, Japan Science and Technology Agency Research and Development. https://www.jst.go.jp/crds/pdf/2011/WR/CRDS-FY2011-WR-13.pdf [In Japanese]

Research and Development Strategy Center, Japan Science and Technology Agency (2017). [Report of the Survey of National and International Education and Research Programs for the Creation of the Core Content for the “Science of Science, Technology and Innovation Policy”] CRDS-FY2017-RR-03, Strategic Center, Japan Science and Technology Agency Research and Development. https://www.jst.go.jp/crds/pdf/2017/RR/CRDS-FY2017-RR-03.pdf

Strategic Center, Japan Science and Technology Agency Research and Development (2019). Beikoku “Kagaku innobeshon seisaku no tame no kagaku” [Trends and analysis of the US “Science for Science Innovation Policy] (2019, updated edition), Survey Report CRDS-FY2018-RR-05, Strategic Center, Japan Science and Technology Agency Research and Development. https://www.jst.go.jp/crds/pdf/2018/RR/CRDS-FY2018-RR-05.pdf [In Japanese]

Kanemoto Y. (2020) EBPM wo seisaku keisei no genba de yakutataseru tame ni [Making EBPM useful in the field of policymaking]. In Ohashi, H., ed. EBPM no keizaigaku: ebidensu wo juushishita seisaku ritsuan [EBPM economics: Evidence-focused policy-making]. University of Tokyo Press. http://www.utp.or.jp/book/b491810.html [In Japanese]

National Diet Library (2020). EBPM (evidence-based policy-making) efforts and issues: A comprehensive survey report. Survey Materials 2019-3, National Diet Library. Available at: https://www.ndl.go.jp/jp/diet/publication/document/2020/index.html#rm1230577 [In Japanese]

Kobayashi, Y. (2020) Nihon ni okeru ebidensu ni motozuku seisaku keisei (EBPM) no genjou to kadai [The present status of and issues surrounding evidence-based policy-making (EBPM) in Japan], ga senkousuru bun'ya kara nani wo manabi nani wo norikoeru hitsuyou ga aru no ka [What do we need to learn from and overcome in fields where EBPM takes precedence?]. Japan Evaluation Study, 20(2):33–48 Available at: http://evaluationjp.org/files/Vol20_No2.pdf [In Japanese]

National Graduate Institute for Policy Studies (2014). 「Kagaku gijutsu inobeeshon seisaku ni okeru ‘seisaku no tame no kagaku’no suishin ni muketa shikouteki jissen」[Trial practice for the promotion of “science for policy” in science and technology innovation policy]. National Graduate Institute for Policy Studies (Commissioned by MEXT in 2013). Available at: https://scirex.grips.ac.jp/resources/archive/140612_395.html [In Japanese]