8 Innovation surveys: experience from Japan

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1. INTRODUCTION

This chapter describes the Japanese experience of innovation surveys. Innovation is recognized as essential for sustainable growth and economic development. Innovation policy requires evidence to support it. The measurement and analysis of innovation activities and the innovation system provide the fundamental evidence required.

Economic activities are globalized. In these circumstances, innovation policy needs to take this into account when dealing with the national innovation system. This can be done by undertaking internationally harmonized measurement of innovation. Japan, as an OECD member country, has contributed to this harmonization. Also, it has adapted it to the Japanese environment in order to exploit rich and useful information from the results. Some of what makes Japan different is now described.

First, Japan is a non-EU country. Innovation surveys have been conducted as repetitions of the Community Innovation Survey (CIS) in European countries. In other non-EU OECD countries, including Japan, Korea and China, innovation surveys have been conducted that are comparable with the CIS. In the case of the European Economic Area (EEA) countries, each country has to transmit the determined statistics to Eurostat according to an EU decision[2] and regulation.[3] These provide the justification for each country to conduct an innovation survey and to provide the results to Eurostat, the statistical office of the EU. However, Japan has no framework for regulating an innovation survey. For this reason, enormous effort is needed to reach understanding on the necessity of conducting an innovation survey with wider stakeholders as well as with direct users and to receive official approval to do so.

Second, Japan has a different cultural and social background from other countries, especially European countries. For example, Japanese is quite different from languages used in Europe and America and is expressed by different types of characters. Concepts represented held by the Japanese may differ considerably from those used in the European and American countries. Hence, in statistical surveys, the understanding

of respondents may deviate from that of those in other countries if the questionnaire is not translated carefully. In particular, innovation is a topic that has been unfamiliar and has come to be known only recently. This different background may influence the design and implementation of statistical surveys.

Third, in Japan, the innovation survey has been conducted as an official statistical survey by an institute that was originally established to conduct policy research. This is also the case for some other countries, such as Germany (Chapter 6) and Korea. National statistical offices retain statistical competences, in general. On the other hand, when policy research institutes conduct statistical surveys, they are able to design a questionnaire that directly reflects policy relevance and takes account of the analytical perspective. The Japanese experience, to be described further below, may provide suggestions for the linkages between the statistical implementation function and the research function.

This chapter describes the Japanese experience in conducting innovation surveys by demonstrating similarities and differences between Japan and other countries, especially EU member states. It also tries to address challenges in order to contribute to developing a framework for making the measurement of innovation more effective and more useful for the production of internationally comparable indicators and data. Then it describes the framework and background for conducting innovation surveys in Japan. It deals with how innovation is recognized, what has been the policy background, and what are the characteristics of the statistical system. After that, it shows the outlines of innovation surveys, including questionnaires and methodologies. Also, it presents how data and indicators from the Japanese innovation surveys have been used and have made an impact. Finally it shows what has been learned in Japan and provides some suggestions for ensuring internationally comparable statistics.

2. FRAMEWORK AND BACKGROUND FOR CONDUCTING INNOVATION SURVEYS

Understanding of 'Innovation' in Japan

In terms of language, understanding of 'innovation' in Japan has been slightly different from that in other countries using alphabets because Japanese uses two types of characters, ideograms and phonograms. Formerly, words borrowed from foreign languages were translated into ideograms using Chinese characters. At present, however, more and more words are borrowed from English, such as computer and Internet,

and these have been expressed in phonograms due to the difficulties in finding suitable and common ideograms. Innovation is now expressed as *inobeshon* in phonograms in Japanese.

In academia, the concept of innovation, that is new combinations of existing constituents, was introduced early on. The English translation of Schumpeter (1911), written in Germany, was published in 1934. The Japanese version, translated by the scholars who studied under him, was also published in 1937.

In policy, the innovation was first mentioned in the *Annual Report on the Japanese Economy* in FY1956 (EPA 1956). In this document, the word *inobeshon* was first used in a policy document and was accompanied by the Japanese equivalent in an ideogram, *gijutsu-kakushin*, which meant 'technologically radical change' in a literal translation. After that initial introduction, the word 'innovation' was not used for a long time in Japanese business and society, and innovations were recognized as technologically radical changes, which are limited in comparison with what innovation should mean.

Development of Innovation Policy and Needs for the Measurement of Innovation Activities to ensure Policy Making

The current assessment is that the promotion of innovation has not been well treated as a prioritized policy issue by the Japanese government. Innovation policy is now treated as an extension of science and technology policy. While the importance of innovation has been recognized in small and medium enterprise policies since the 1980s, the word 'innovation' has not been used. In the current policy framework, stipulated by the Science and Technology Basic Act, the government decides the Science and Technology Basic Plan (STBP), which is a five-year policy guideline for the promotion of science and technology with a decadal perspective. The third STBP for FY2006–FY2010 was the first to use the word 'innovation', but it had not developed innovation policies. In the Abe Administration of 2006–07, the first Minister of State for Innovation was appointed. Then the long-term strategic guidelines, 'Innovation 25', was adopted by the Cabinet. But it was hardly referred to or developed after that because it merely collected existing recommendations. In addition, the prime minister changed, and that removed a driver of the issue. In 2008, the so-called Act for Enhancing Research and Development Competences was enacted. It was the first to use the word *inobeshon* in the text of Japanese laws. Also, it states that the creation of innovation, as well as the increased level of science and technology, shall be the purposes of enhancing R&D capacities as a nation. The fourth STBP for FY2011–FY2015

adopted by the Cabinet in August 2011 stated that the innovation policy shall be included in the scope of the policy framework, and promoted and integrated with science and technology policy.

However, in the fourth STBP, the necessity of a fundamental statistical survey with a view to underpinning innovation policy was not present. Also, the results of innovation surveys have not, as yet, been utilized as evidence for policy making.

The Innovation Survey in the Statistical System of Japan

The framework of official statistics in Japan is regulated by the Statistics Act, which was enacted in 2007 and replaced the previous Statistics Act of 1947 and the Statistical Reporting Co-ordination Act of 1952.

The Japanese statistical framework is characterized by a mixture of centralized and decentralized systems. Some official statistical surveys have been conducted by many mission-oriented administrative offices, including ministries; other official statistical surveys related to the nation, people's lives and business activities in general, such as the Population Census, the Labour Force Survey and the Economic Census for Business Activity, are conducted by the Statistics Bureau of the Ministry of Internal Affairs and Communications, the national central statistics office.

All the official statistical surveys are required to receive approval by the Minister for Internal Affairs and Communications, who is responsible for official statistics, and the Directorate General for Policy Planning (Statistical Standards) was established within the Ministry of Internal Affairs and Communications (MIC) to review statistical surveys and to establish statistical standards. Also, in the current statistical system, the Statistics Commission is established within the Cabinet Office to deliberate on the basic plans of developing national official statistics, the guidelines for building the system of national accounts, and core statistical surveys.

Under this administrative and statistical system, the National Institute of Science and Technology Policy (NISTEP) is deemed to be the most appropriate institute for conducting innovation surveys. NISTEP is a research institute on science and technology policy within the Ministry of Education, Culture, Sports, Science and Technology (MEXT).

In Japan, innovation policy is implemented as an extension of science and technology policy. In the administrative system, each ministry is required to coordinate with the others, including the Cabinet Office, to discharge the administrative function as a whole in the government in order to execute its own duties. The mandate of MEXT, stipulated in the Act of Establishing the MEXT, includes the planning, formation and promotion

of basic policies related to science and technology and the assessment of impacts of R&D on economy, society and people's lives. The Council for Science and Technology Policy (CSTP) of the Cabinet Office is the highest coordination and advisory body on science and technology policy in the government. It is chaired by the prime minister, and is composed of six ministers and eight learned members. It has the role of reviewing and deliberating upon basic policies and guidelines for allocation of resources, including budget and human resources, that are necessary for promoting science and technology as well as giving opinions on basic policies and critical issues. CSTP has the responsibility for design, planning and general coordination of policies, but has a limited implementation function. For this reason, statistical surveys that may contribute to the duties of the CSTP have to be conducted by other administrative institutes.

Official statistical surveys can be classified into the following two types:[4] 'core statistical surveys' and 'general statistical surveys'. 'Core statistical surveys' include the Population Census, the Economic Census for Business Activity and other statistical surveys that were introduced much earlier, just after 1945. 'Core statistical surveys' can be mandatory surveys. On the other hand, many recently established surveys have remained as 'general statistical surveys' and must be voluntary surveys. Under these conditions, the innovation survey, which started recently, has been treated as a 'general statistical survey' and it is impossible to impose a mandatory response.

Also, while the 'Basic Plan of Developing National Official Statistics' was adopted by the Cabinet in 2009 on the basis of the deliberation by the Statistics Commission, it mentioned neither R&D nor innovation. Then, at the stage where science, technology and innovation policies were envisaged to be developed in the framework of the fourth STBP, the Statistics Commission showed an interest in innovation statistics, and held a meeting with statistical users. In Japan, the discussion on the measurement of innovation at the governmental level has just started. This contrasts with the EU, where the implementation of innovation statistics has been reported to the European Parliament and the Council of the European Union,[5] and the development of innovation indicators at different levels has been undertaken,[6] and with the USA, where the measurement of innovation has been discussed by the National Research Council[7] and the Department of Commerce.[8]

Secondary use of statistical data has to be balanced between the effective exploitation of statistical data and the protected confidentiality of respondents. Under the previous Statistics Act, secondary use of statistical data was prevented in principle. Mandatory surveys could be used for secondary purposes, but only if the secondary purposes were specified and

especially approved. Voluntary surveys could be used for secondary purposes but only if the data were anonymized. Under the current Statistics Act, secondary use can take place, which makes it possible to compile other statistics and to conduct statistical research in general. However, the secondary use of filled-in questionnaires is still strictly limited.

The secondary use of data from the innovation surveys has been permitted under certain conditions and through the prescribed procedures. Yet the proposed secondary purposes are sometimes not compatible with confidentiality. Also, the secondary use has often had negative effects due to the incomplete understanding of the survey itself and the inappropriate interpretation of analytical results.

NISTEP as a Statistical Office

NISTEP is one of the survey implementation institutes as it conducts the innovation survey as an official statistical survey. In general, the design of statistical surveys requires making proactive responses to policy issues and assuming that analytical research will make use of the results. Also, the design and implementation of the survey requires the knowledge, competence and skills of statistical surveying. As a policy research institute, it must anticipate policy makers' inquiries and capture probable policy needs and issues. NISTEP is located close to the offices of policy makers in MEXT and CSTP. But, as the policy makers tend to tackle short-term issues, the fundamental research institute is a suitable place for designing surveys with mid- or long-term perspectives.

The innovation survey was the first official statistical survey for NISTEP.[9] As a result, the competences needed to produce official statistics had to be acquired.

3. OUTLINES OF INNOVATION SURVEYS

This section describes the Japanese National Innovation Survey 2003 (J-NIS 2003), which was conducted by NISTEP as the first round of official statistical surveying in Japan as well as the CMU-NISTEP survey that had been conducted by NISTEP before the J-NIS 2003.

CMU-NISTEP Survey

Motivation

Levin et al. (1987) did an empirical study on innovation activities in firms using a questionnaire survey called the 'Yale Survey' because

of the researchers' affiliation. It had a considerable impact on the innovation studies that followed. Among them, one survey was conducted as an internationally comparative study based on the Yale Survey, and was called afterwards the 'Yale II Survey' or the 'CMU-NISTEP Survey'. The Japanese side of the survey was conducted by NISTEP. The US side was conducted by Carnegie Mellon University. The motivation of the survey was to clarify the mechanism of innovation, especially in terms of technological opportunity and appropriability. Although attempts had been made to cooperate with the EU, the survey was eventually conducted as a joint survey between Japan and the USA. Later, the EU conducted the second Community Innovation Survey (CIS 2).

Questionnaire

The questionnaire of the 'CMU-NISTEP Survey' was well coordinated and designed in advance by the researchers in both countries. As for the survey, it is important to deal with the effects due to the differences in language in order to have internationally comparable results. As a first step the English version was designed. Then the Japanese version was prepared based on the English version. In addition, the Japanese version was translated into English by a third party, and both versions were compared in order to ensure that they were identical.

Survey methodology

The population of the Japanese side of the CMU-NISTEP survey was 1219 R&D-performing large-sized firms with ¥1 billion or more of paid-in capital in manufacturing, which had been identified by the Science and Technology Agency (STA), one of the predecessors of MEXT. All of them were selected as the sample for the survey. The survey questionnaire was sent by post on September 1994. Of the firms surveyed, 643 firms responded, giving a response rate of 52.7 per cent. This relatively high rate was helped by sending out a reminder.

Key results

From this survey, Cohen et al. (2002) clarified the similarities and differences in knowledge flows and spillovers in terms of technological opportunity and the role of patents in terms of appropriability. Before this, Goto and Nagata (1997) showed the preliminary survey results in Japanese.

Important experience

Throughout, deliberations were made in the preparation and completion of the survey for both sides to ensure international comparability of the

results. Also, in terms of language, great care was taken in the translation of the questionnaire.

Attention was paid to the correspondence of industrial classifications and to the currency exchange rate between the countries. The survey results in international comparison were represented by using weights by industrial classification in consideration of difference in industrial structure, or distribution of firms among economic activities. In other words, this suggests that simple representation of the results from innovation surveys would include the difference in industrial structure in each country.

Furthermore, the population for the CMU-NISTEP survey differed substantially from that for the CIS and the J-NIS 2003. The sample size was much smaller than that of those innovation surveys.

J-NIS 2003 as the First Official Statistical Survey on Innovation in Japan

Background

When the J-NIS 2003 was initiated, few policy makers had paid attention to innovation policies, but policy researchers and some policy makers had recognized that an understanding was needed of innovation systems and how to make them function better in areas such as industry–academia linkages.

In the latter half of the 1990s, researchers in NISTEP had observed that, in the EU, innovation policies attracted more and more interest and resulted in the exploitation of the data from the CIS. As policy analysts, they acknowledged the importance for Japan of expanding policy interests to include innovation policy, going beyond science and technology policy. They also anticipated that national data of selected indicators from innovation surveys, based on the *Oslo Manual*, would be collected by international organizations, such as the OECD, and shared internationally in future in the same way that data from R&D surveys, based on the *Frascati Manual* (OECD 2002), had been compiled. As some time had passed since the CMU-NISTEP survey, there was an expectation that there would be another innovation survey in Japan.

At that moment, the OECD (Muzart 1999) examined international comparability on the basis of the survey results from the CIS 1 and the CIS 2. Considering the findings, OECD and Eurostat jointly developed the core questionnaire and the recommended survey methodology for the CIS 3, while starting discussions towards revision of the *Oslo Manual*. The researchers in NISTEP understood the issues of innovation surveys through these activities, and started to consider both the survey questions and the survey methodology that could be implemented in Japan. In

parallel, thanks to discussions with the experts in the OECD Secretariat, Eurostat, and institutes conducting CIS and those publishing statistical reports, they learned from their experience.

In addition, in 2001, under the second STBP (FY2001–FY2005) that aimed at reforms of the science and technology system, it became possible to ensure the resources for conducting a new round of innovation surveys that would contribute to a better understanding and improvement of the innovation system, including industry–academia linkages.

In Japan, when institutes conduct official statistical surveys, they have to receive the approval from MIC. After starting this survey project, NISTEP enhanced coordination within the institute, including the involvement of the researchers in charge of the Japanese side of the CMU-NISTEP survey, in order to receive approval smoothly and to implement the survey appropriately. In the process of receiving approval, the draft questionnaire and the draft survey methodology were scrutinized by the Directorate General for Policy Planning (Statistical Standards), which further requested the Japan Business Federation to have them examined by its member companies.

Questionnaire

As for the questionnaire of the J-NIS 2003, it was decided to utilize the core questionnaire and the recommended survey methodology for the CIS 3. This provided a basis for non-EU countries to develop international comparability.

The questionnaire was prepared not only in Japanese but also in English. The English version followed the text used in the core questionnaire for the CIS 3 as closely as possible.

At the time, most of the firms in Japan were not familiar with the term and concept of 'innovation'. The researchers in NISTEP distinguished between 'innovation' and '*gijutsu-kakushin*', or technologically radical changes. For this reason, NISTEP was urged to prepare the English version as well as the Japanese version when MIC approved implementation of the J-NIS 2003. The condition was based on the comments from some firms that participated in the pre-test of the questionnaire requested by the Directorate General for Policy Planning (Statistical Standards).

Also, to ensure consistency between the versions, the draft Japanese version questionnaire was translated into English by an independent expert translator, and the translated document was compared with the English version.

In addition, some specific questions were added to collect useful information for Japan, and some questions were modified to fit in the Japanese setting, while not jeopardizing international comparability.

First, questions on non-technological innovation that had already been included in the core questionnaire of the CIS 3, such as organizational changes, strategy, marketing and aesthetic changes, were subdivided so as to present the changes in more detail. It had been discussed in NESTI that non-technological innovation as well as technological innovation should be observed. Freeman (1987), who produced the first publication which referred to the national innovation system (Edquist 2005), mentioned that the Japanese innovation system in the 1980s was characterized by organizational and marketing innovation. Accordingly, it was interesting to see whether these characteristics would be still observed at the beginning of the 2000s.

Second, some questions related to the appropriability in the CMU-NISTEP survey were added to the J-NIS 2003 so as to observe the changes between the two surveys. In general, as indicated in data of patent applications and registrations to the main patent offices in the world, many large Japanese firms in manufacturing have emphasized intellectual property as well as R&D activities.

Third, alternatives in some questions related to geographical issues, such as areas of activities, locations of partners of innovation activities and information sources, were subdivided for the Asian economies with which the firms in Japan had close relations in economic and trade activities so as to obtain more detailed information.

Survey methodology

Outlines of the survey methodology for the J-NIS 2003, including the quality, are described in the appendix.

In particular, industrial classifications and enterprise size classes were carefully designed. The results of statistical surveys should be easily connected to other national statistics and be internationally comparable. To satisfy these requirements, the strata were established so as to correspond with both the Standard Industrial Classification of Japan (SICJ) and the International Standard Industrial Classification of All Economic Activities (ISIC) as much as possible by using lower levels of the SICJ. The strata in enterprise size classes were established on the basis of the *Oslo Manual*, in spite of Japanese conventional classifications.

Non-response analysis

As the J-NIS 2003 was a voluntary survey according to the regulations of the Japanese statistical system, the response rate was 21 per cent, which was lower than that in other countries conducting the CIS 3.

The results of the non-response analysis showed that many firms declined to reply to the survey because it was the first round, although they

clearly understood which divisions should take charge of the reply. They also implied that more innovating firms and more innovation-active firms might exist among non-responding firms than among responding firms. As 10 per cent of firms declined to participate even in the non-response analysis, the survey results were not adjusted.

Succeeding Surveys

The Japanese National Innovation Survey 2009 (J-NIS 2009), the second round of the innovation survey in Japan, was conducted by NISTEP in 2009. The questions of the J-NIS 2009 differed from those of the CIS 2008, although the J-NIS 2009 was intended to follow the *Oslo Manual*.

It was expected that the questions would be better understood and more easily filled in by the firms in Japan. Some alternatives were simplified and integrated. Also, instead of filling in figures, respondents were asked to reply within specified numeric intervals. As a result, the J-NIS 2009 became less comparable with the CIS. Also, questions on the recognition of market structure by firms were added besides the core questions of the CIS 2008.

As mentioned above, the J-NIS 2009 was different from the J-NIS 2003 as well as from the CIS. For this reason, the J-NIS 2009 is subject to restriction in data availability, especially for internationally comparable innovation indicators that are newly developed.

Now, the Japanese National Innovation Survey 2013 (J-NIS 2013), the third round of the innovation survey in Japan, has been launched. The reference period of the J-NIS 2013 is the years 2009 to 2011. In light of the experience of the J-NIS 2009, the J-NIS 2013 is designed to be comparable with the CIS 2010 again as much as possible, given the limited resources.

4. IMPACTS OF THE SURVEY

The statistical report of the J-NIS 2003 (Ijichi et al. 2004) was published. Also, for data on manufacture of pharmaceuticals that were not tabulated in this report due to a subdivision in a stratum, Ijichi and Odagiri (2006) tabulated the results of the industry and clarified the characteristics in comparison with those of all the economic activities and with manufacturing.

The data from the J-NIS 2003 have been utilized as the Japanese data on innovation activities based on innovation surveys in several OECD reports (OECD 2007, 2008, 2010a). Also, OECD undertook the Innovation Strategy, in which the development of new internationally comparable indicators and analyses was also proposed (OECD 2009, 2010b, 2010c,

2010d). For this work, the national data were utilized. In addition, researchers and businesses were interested in the survey and referred to the data in their works or publications. Some of them contacted NISTEP to make further enquiries.

The experiences of the J-NIS 2003 were utilized in the revision of the *Oslo Manual*, especially for the deliberations on non-technological innovation. They were also shared through seminars (Ijichi 2008).

On the other hand, the survey results were also misused. For example, in the OECD *Economic Survey*, although the data from the J-NIS 2003 were mentioned within the reports (OECD 2006; Jones and Yokoyama 2006), neither the survey nor the statistical report was referred to accurately, with the note that '[t]here is a need for caution in evaluating such surveys because of the low response rate in Japan'. They were concerned about the quality of the J-NIS 2003 only because of the lower response rate, without considering the survey methodology and the result of non-response analysis. The J-NIS 2003 was also partially utilized and mentioned by the Annual Economic and Fiscal Report of FY2005 (Cabinet Office 2005), a yearly macroeconomic report by the Minister of State for Economic and Fiscal Policy, and its related staff discussion paper (Nakano 2005). The data from the J-NIS 2003 were complemented by a small-sample non-official survey that was commissioned to a private research firm by the Cabinet Office.

At this writing, the results of the J-NIS 2003 have not been used well in policy making. This might raise questions, such as whether the J-NIS 2003 was conducted too early and whether policy making requires such evidence in Japan. However, the results of the J-NIS 2003 indicate that the Japanese innovation system can be characterized as large firm dominated, non-technological oriented and less internationally active in comparison with the systems of other countries. The results suggest that innovation policy should focus on innovation-active firms, especially small- and medium-sized innovation-active firms, to promote new-to-the-world product innovation as well as on improving linkages between different actors and framework conditions. Now that, in the light of the fourth STBP, the government intends to promote evidence-based policy making for science, technology and innovation, it is envisaged that innovation statistics will be utilized more appropriately and effectively by policy makers and will also be emphasized in the near future.

5. CONCLUSION

This chapter described how innovation statistics have been developed and what has been learned so far in Japan.

On the user side, there has been insufficient recognition of innovation policies and inappropriate recognition of measurement and statistics for ensuring policy making and analysis. In these circumstances, the producer side needs to anticipate user needs in advance and to implement the necessary surveys. In this regard, Gault (2011; Chapter 1 in this volume) discusses how manuals, surveys and indicators of innovation statistics have been developed and used in terms of the social impact.

The development of innovation statistics has been linked, stimulated and supported by the activities of the OECD (Chapter 12), and the various efforts of the EU and of many countries.

The J-NIS can provide information on various characteristics of the Japanese innovation system. For example, the data from the previous surveys show lower ratios of product- and process-innovative firms and of innovation-active firms in Japan rather than in other countries. Also, the information on sample errors, especially for the large-sized firms that were collected by census, became available.[10] Nevertheless, some concerns about the quality of the statistical surveys were raised because those findings were different from the stylized image that Japanese industry was eager to promote.

It is important to anticipate long-term and irreversible trends of policy issues. In general, statistical surveys require a long time to be conducted and to produce results and suggestions, while policy needs for the quantitative information sometimes arise.

What is Needed to Conduct a Statistical Survey Outside the Framework of the EU?

A research institute

In Japan, as a non-EU country, it was necessary for NISTEP to ensure that relevant stakeholders understood the necessity to conduct innovation surveys before the survey was started. On the other hand, in the EEA countries, it is now stipulated by an EU decision and a Commission regulation that the member states shall complete and transmit the innovation statistics to the European Commission (Eurostat). To do so, as a consequence, the member states are obliged to conduct innovation surveys. In addition, the data obtained by the innovation surveys have been continuously utilized as various indicators, and in reports and publications by the European Commission as well as the member states themselves so as to monitor the situation.

As for innovation statistics, the data exploitation and provision through international organizations have contributed to obtaining better understanding of the measurement of innovation from wider stakeholders. The

same applies to R&D statistics, which are obtained through R&D surveys conducted by many countries on the basis of the *Frascati Manual* and which result in various kinds of publications both by each country and by international organizations such as the OECD.

Furthermore, in the current Japanese statistical system, it would have been difficult for the central statistical institute to conduct the statistical surveys that require expertise in novel subjects, such as innovation, and to improve in each round. It was necessary that a research institute that was addressing policy needs, and had the research capability, took on the role.

In any case, to allow an international comparison for statistical surveys, it is important for cooperation between countries, through international organizations, to undergo continuous improvement and internationally harmonized implementation, while being satisfied with or reconciling specific requirements in each country.

What has been learned and some implications for further work

The experience gained suggests that the institutes should be well grounded in the four types of competences, knowledge and skills.

First, in terms of statistical interests, as data producers, it is indispensable for the institutes to have specialized knowledge and skills in designing and implementing statistical surveys.

Second, in terms of policy and administrative interests, they must ensure relevance to policy issues and needs in designing statistical surveys. Also, official statistical surveys need to perform various administrative procedures. For this reason, it is desirable for them to cope with those processes appropriately.

Third, in terms of research and knowledge creation interests, the institutes should have the perspective of the data users in order to design more meaningful questions and to better exploit the survey results. It is valuable for them to anticipate future or potential policy issues besides current policy topics.

Also, it is appropriate for them to understand innovation studies in order to better understand innovation systems. For example, as for the economic approach to innovation, it should be taken into account which variables should be utilized and combined, and how those variables would be used for analysis.

In addition, it is important for them to have broad knowledge related to innovation. This includes management and accounting for innovation-active firms. To reduce the respondents' burden, it is desirable that the survey questionnaire be designed to reduce the gap between what should be observed and what has been practised in the firms as much as possible. FAQs should be also prepared to bridge the gap.

Furthermore, it is essential for them to know how the respondents in the firms comprehend innovation and the innovation survey questionnaire. It is crucial for them to accumulate knowledge on many cases of varied innovations.

Finally, in terms of international interests, the institutes should take an active role in international collaboration in order to ensure international comparability. As it might be an inherent characteristic in Japan, where the country is not regulated by any international framework for innovation statistics, unlike the EU member states, it is exhausting to argue the necessity for international collaboration with other organizations, including the statistical regulation office not interested in innovation policies.

In this regard, the existence of the *Oslo Manual* is critical in the process of receiving approval for conducting innovation surveys. In Japan, not only ensuring but also improving international comparability of statistical standards and surveys coincide with the stipulations of the current Statistics Act and the guidelines indicated in the current 'Basic Plan of Developing National Official Statistics'. The *Oslo Manual* is indispensable to gain more shared understanding about the international relevance of innovation statistics within the country. For this purpose, it is beneficial to provide the experience and to contribute to the revision and improvement of the *Oslo Manual*.

The institutes have often been requested to provide information on the current situations of innovation surveys and statistics in other countries as well as on the latest data resulting from innovation statistics. Now that the promotion of innovation is one of the main policies in many countries in the world, it is also desirable for international organizations to provide continuously internationally comparable data and metadata by collecting those from each country.

NOTES

1. The views expressed in this chapter are solely those of the author, and do not necessarily represent the view of any organization.
2. Decision No. 1608/2003/EC of the European Parliament and of the Council of 22 July 2003 concerning the production and development of Community statistics on science and technology, *Official Journal of the European Union*, L 230, pp. 1–3, 16.9.2003.
3. Commission Regulation (EC) No. 1450/2004 of 13 August 2004 implementing Decision No. 1608/2003/EC of the European Parliament and of the Council concerning the production and development of Community statistics on innovation, *Official Journal of the European Union*, L 267, pp. 32–5, 14.8.2004.
4. Under the previous Statistics Act before 2007, the official statistics were composed of 'statistical surveys' and 'collections of statistical reporting' which required approvals by the Minister for Internal Affairs and Communications on the basis of the Statistical Reporting Co-ordination Act.

5. Commission of the European Communities, 'Report from the Commission to the Council and the European Parliament on the implementation of Decision No 1608/2003/EC of the European Parliament and of the Council', Brussels, 14.12.2007, COM(2007) 801 final; European Commission, 'Report from the Commission to the European Parliament and the Council on the implementation of Decision No 1608/2003/EC of the European Parliament and of the Council on science and technology statistics', Brussels, 11.4.2011, COM(2011) 184 final.
6. For example, the High-Level Panel on the Measurement of Innovation in the Directorate General of Research and Innovation published a report recommending key elements for the headline indicator of innovation for the Europe 2020 strategy as well as other thematic reports.
7. The US National Research Council has repeatedly set up panels to conduct studies on the measurement, statistics and indicators of innovation under the sponsorship of the National Science Foundation (NSF). The report *Measuring Research and Development Expenditures in the US Economy* was published in 2005. A panel has been conducting the project 'Developing Science, Technology, and Innovation Indicators for the Future' since 2011, and has published an interim report (National Research Council of the National Academies 2012).
8. The Advisory Committee on Measuring Innovation in the 21st Century Economy established in the US Department of Commerce published the report 'Innovation Measurement: Tracking the State of Innovation in the American Economy' in 2008.
9. The Technology Foresight Surveys used to be conducted as official statistical surveys. They, however, were not typical.
10. For example, the percentage of large-sized product and process innovating enterprises in manufacturing and mining was 56 ± 3% (95% confidence intervals).

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APPENDIX: OUTLINE OF THE SURVEY METHODOLOGY FOR THE J-NIS 2003

The survey methodology for the J-NIS 2003 basically followed that for the CIS 3.

The target population was all the enterprises in the economic activities in the SICJ Rev. 10 that corresponded to agriculture, hunting and forestry (ISIC Rev. 3, Section A), fishing (B), mining and quarrying (C), manufacturing (D), electricity, gas, heat supply and water (E), wholesale trade and commission trade, except of motor vehicles and motorcycles (Division 51 in G), transport, storage and communications (I), financial intermediation (J), computer and related activities (72), research and development (73), and architectural, engineering and other technical activities (Group 742). Sections A and B were also covered beyond the frame for the CIS 3 because those industries were covered by the R&D survey in Japan. The frame population was all the enterprises with ten or more 'persons engaged' in those industries. In the Japanese statistical framework, 'persons engaged' means all people who belong to and work for the enterprise, including permanent employees and paid executives. The observation period was between 1 January 1999 and 31 December 2001. The reference year was 2001.

The survey participation was voluntary. The survey type was a combination of census and sampling where large-sized firms, that is, enterprises with 250 or more persons engaged, were covered by census.

The variables used for the stratification of the sample were both the economic activity of the enterprise (64 classes) and the number of persons engaged in the enterprise (three classes: 10–49, 50–249 and 250+). A stratified random sampling was applied for the sampled enterprises. The results of the Establishment and Enterprise Census 2001 were used as sampling frame. The size of the frame population was 216 585. The sample size was 43 174 (i.e. the sample rate was 20 per cent). The number of realized samples was 9257 (i.e. the unweighted response rate was 21 per cent). Weighting factors were calculated as the inverse of the sampling fraction.

The survey was conducted from January to March 2003. The questionnaire was sent by post, and the filled-in questionnaire was collected by post. The electronic questionnaire (PDF file) was sent upon request. The Japanese version questionnaire was mainly used, and the English version questionnaire was used upon request. Reminders were sent twice by post. Reminder calls were also made to the enterprises in the strata where the response rates would be lower without any further contact.

Quality checks were applied. Concerning measurement errors, some firms reported the data inconsistently, especially for numeric variables,

which were edited manually as much as possible on the basis of reliable variables.

All the realized samples reported key variables for identifying innovating firms and innovation-active firms. When firms omitted to respond for those variables, they were contacted by telephone to complete.

Coverage errors were not observed.

A non-response survey was conducted for 339 firms. Only 294 responded and imputation was not used. Due to the low rate of response, the results were not used to adjust the survey weights.

The statistical report was published in December 2004.

In terms of coherence with R&D and business statistics, the data of the J-NIS 2003 were compared with those of the R&D survey of 2002 and the Basic Survey of Japanese Business Structure and Activities of 2002. For example, the reporting on R&D performing and patent holding was more or less consistent. The exercise also suggested that non-response and inconsistent reporting between different surveys should be further reduced for better microdata analysis and additional statistics by combining them, although there were still challenges regarding differences in frame population and sampling method.