APEC Sub-Committee on Standards and Conformance

APEC Guidelines on
Standards Infrastructure

APEC Guidelines on Standards Infrastructure

Asia-Pacific Economic Cooperation

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Abbreviations and Acronyms

In the text, for readers' convenience, we add the name of an economy with a slash to an institution's acronym i.e. BSN/Indonesia and DGN/Mexico. However, when it is very clear from the context or repetitive uses, we do not add the economy name.

ANS	American National Standards
ANSI	American National Standards Institute
APEC	Asia-Pacific Economic Cooperation
APLAC	Asia Pacific Laboratory Accreditation Cooperation
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BPS	Bureau of Product Standards, The Republic of the Philippines
BSN	National Standardization Agency of Indonesia (Badan Standardisasi Nasional)
CNII	Critical National Information Infrastructures, Malaysia
COPANT	Pan-American Standards Commission (Comision Panamericana de Normas Tecnicas)
COSD	Co-operation Organization for Standards Development, Korea
CSL	Competition, Standards, and Liberalization, Malaysia
CSP	Certified Standards Professional, Korea
DFAT	Department of Foreign Affairs and Trade, Australia
DGN	National Bureau of Standards (Dirección General de Normas), Mexico
DIN	German Institute for Standardization (Deutsches Institut fuer Normung)
DSM	Department of Standards Malaysia
EEMRA	APEC-SCSC Electrical and Electronic Equipment Mutual Recognition Arrangement
GAP	Good Agriculture Practice, Malaysia
GRP	Good Regulatory Practices
HRD	Human Resources Development
IAF	International Accreditation Forum
ICV	Innovation & Capability Voucher, Singapore
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ILAC	International Laboratory Accreditation Cooperation

INDECOPI	National Institute for the Defense of Competition and Protection of Intellectual Property (Instituto Nacional de Defensa de la Competencia y de la Protección de la Propiedad Intelectual), Peru
ISO	International Organisation for Standardization
ITC	Innovation and Technology Commission, Hong Kong, China
ITU	International Telecommunication Union
IVS	Innovation Voucher Scheme, Singapore
JISC	Japanese Industrial Standards Committee
JSA	Japanese Standards Association
KAB	Korea Accreditation Board
KATS	Korean Agency for Technology and Standards
KS	Korean Industrial Standards
KSA	Korean Standards Association
KSIC	Korean Standards Information Center
KSSN	Korean Standards Service Network
MASTAN	Indonesian Standardization Society (Masyarakat Standardisasi Indonesia)
MBIE	Ministry of Business, Innovation and Employment, New Zealand
MITI	Ministry of International Trade and Industry, Malaysia
MOA	Ministry of Agriculture, Malaysia
MOH	Ministry of Health, Malaysia
MOSTI	Ministry of Science, Innovation, and Technology, Malaysia
MOU	Memorandum of Understanding
MRA	Mutual Recognition Arrangement
MS	Malaysian Standards
NCAP	National Conformity Assessment Principles, United States
NGO	Non-Governmental Organizations
NIST	National Institute of Standards and Technology, United States
NKEA	National Key Economic Area, Malaysia
NORMEX	Mexican National Society of Standardization (Sociedad Mexicana de Normalización y Certificación)
NSB	National Standardization Body
NSC	National Standards Coordinator, Korea

NSSN	National Resource for Global Standards, United States
NTTAA	National Technology Transfer and Advancement Act, United State
OECD	Organisation for Economic Co-operation and Development
OMB	Office of Management and Budget, United States
OTA	Office of Technology Assessment, Congress of United States
PAC	Pacific Accreditation Cooperation
PEMANDU	Performance Management & Delivery Unit, Malaysia
PMP	Productivity Management Programme, Singapore
R&D	Research and Development
SA	Standards Australia
SAC	Singapore Accreditation Council
SCC	Standards Council of Canada
SCSC	APEC Sub-Committee on Standards and Conformance
SDO	Standards Development Organizations
SM	Standards Malaysia
SME	Small and Medium-sized Enterprise
SRI	Strategic Reform Initiatives, Malaysia
STAMEQ	Directorate for Standards, Metrology and Quality of Vietnam
TBT	Technical Barriers to Trade
TC	Technical Committee
TELMRA	APEC TEL MRA for Conformity Assessment of Telecommunications Equipment
TISI	Thai Industrial Standards Institute, Thailand
TTA	Telecommunications Technology Association, Korea
UL	Underwriter`s Laboratories
UNIDO	United Nations Industrial Development Organization
USSS	United States Standards Strategy
VSQI	Vietnam Standards and Quality Institute
WTO	World Trade Organization
YSO	Youth Standards Olympiad, Korea

Executive Summary

Amid the growing integration of the global economy, standards as a common language which make goods and services exchangeable and compatible in the global market are a key element to an economy's international trade promotion objectives. However, differing national standards systems pose a risk of standards acting as an unnecessary obstacle to international trade.

In the Asia-Pacific region, there have been efforts to reduce Technical Barriers to Trade (TBTs) that arise from different national standards systems. The development of the *APEC Guideline on Standards Infrastructure*, in line with this objective, aims to provide a source of reference on standardization activities within the region, by describing and analyzing the standards infrastructure of the APEC economies, and providing recommendations to achieve greater alignment of national standards infrastructure among the APEC economies. This guideline is an outcome of an almost year-long deliberation and data collection with experts in the APEC region, particularly focusing on the 15 participating economies in the APEC-wide survey including Australia; Canada; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Peru; the Philippines; Singapore; Thailand; the United States; and Viet Nam.

In this report, "*standards infrastructure*" is suggested as a concept to encompass a comprehensive ecosystem of standards and standardization activities in an economy, drawn from a spectrum of standards-related policy areas that are being practiced in APEC economies. The term is defined as "*systems, facilities, environments, information, and human resources to support and facilitate standardization activities, including, inter alia, the development, adoption, and utilization of standards*". In particular, this report investigates government policies and programmes concerning the standards infrastructure in APEC economies on the following five issues: organization of national standardization bodies (NSBs), budget for standardization activities, implementation and dissemination of standards, standards professionals, and standardization strategy and performance.

Organization of NSBs

An economy's national standards infrastructure may take a variety of forms in terms of its governance structure, funding methods, operational management, and stakeholder relations. The research found that in APEC economies, there are two major approaches to institution-building of standards infrastructure. On one hand, a private-led approach has its strength in the openness and flexibility of the National Standardization Body (NSB) which in turn allows a greater room for industry participation and bottom-up innovation. A government-led model, on the other hand, is more advantageous to plan and coordinate various stakeholders and their activities for the maximum benefit of the economy.

In some cases, supporting and collaborating organizations, on behalf of an NSB, directly or indirectly engage in policy implementation and standards development process. A key to successful supporting activities entails engagement and participation of stakeholders and experts, for example, by developing partnerships, holding general engagement events, and maintaining an ongoing communication channel to understand the stakeholders' needs.

Technical committees (TCs) are where the technical expertise in the industry are crystalized into codified knowledge. It is important to create and maintain balanced TCs that bring in the right expertise by setting up clear guidelines for their organization and operation, while promoting a culture that values committee participation.

Budget and Business Model

Maintaining a financial sustainability is a key concern of any NSBs. For NSBs as a government agency, a significant portion of funding comes from the government budget. In this case, it is important to raise awareness of policymakers and appeal to the Parliament or the authority in charge of funding, by prioritizing the standards development and incorporating the goal into the economy's national agenda. NSBs as a private agency, on the other hand, need to diversify the revenue streams, and avoid too much reliance on a single or limited revenue source such as the sales of standards.

In both cases, it is important to demonstrate the value of standardization activities to those who make funding and investment decisions such as the government and industry. Particularly, the engagement of private industry is not only imperative in a political sense, but is also advantageous from the economic perspective as the private sector may and should eventually share the costs of standards development.

Implementation and Dissemination

Standards provide advantages in formulating technical regulations. By translating adequate standards into technical regulations, an economy may control the quality of imported goods, in order to protect the environment and safeguard the health and safety of its citizens. However, as the WTO TBT Agreement stresses, inappropriate implementations of mandatory standards may cause unnecessary obstacles to international trade. To address this concern, some APEC economies have developed specific guidelines on how to use and reference standards for technical regulations, so that alignment between technical regulations and national standards is pursued based on them.

The compliance with technical regulations – mandatory national standards – requires a certain form of confirmation, which may be obtained through testing, certification or inspection by laboratories or certification bodies. However, due to the different conformity assessment systems in economies, such requirements have the risk of becoming TBTs. In order to facilitate trade and reduce unnecessary costs incurred by TBTs, a Mutual Recognition Agreement (MRA), which refers to a bilateral or multilateral agreement among economies through which economies agree to "accept the results of one another's conformity assessment procedures, although these procedures might be different" (WTO, 2013), can be considered as a key policy instrument.

In terms of the dissemination of standards, it is noteworthy that the major channel of dissemination has gradually shifted towards online initiatives with the advancement of ICT in recent years. Many NSBs in the APEC region have already put in place ICT strategies to better engage with stakeholders through online means, for example, by developing online participation tools, websites or web portals through which key information services and online sales of standards documents take place.

Professional development

A human resources development strategy should target different groups of people, including standards professionals, the users of standards in the industry, as well as the general public,

government officials and educators. Standards education within formal school systems provides a good opportunity to raise awareness of the general public as consumers of standards. Standards education/training for working professionals may include training programs for technical committee members, committee chairs or conveners, or secretaries, notably aimed at strengthening the capacities required for participating in international standardization activities.

Another important topic of HRD in standards is the development of skillsets and qualification schemes for professionals. Such a qualification scheme for standards professionals helps evaluate the existing skills and knowledge of standards-related human resources. In addition, it helps define the tasks, processes and methodologies related to standardization activities, and inform and share those tasks within the organization.

Successful HR management requires efforts to recruit, retain and engage with talents. In this sense, it is important to ensure that there are formal mechanisms for knowledge transfer, i.e. through training of trainers. Supportive programs to boost professionals' engagement in standardization activities should be promoted. Last but not least, specialized recruitment opportunities for entry-level positions should be provided in order to attract young talents in the field.

Strategy and performance

The goal of national standardization strategy lies in providing a necessary condition for industries to optimize the use of standardization. An economy's standardization should articulate a goal-oriented vision as well as a clear steering point to plan, align, implement and evaluate standardization activities at a national level as well as at a sectoral level. Sectoral strategies should focus on emerging global issues and new technology, reflecting the economy's industrial competitiveness.

An important topic for the standardization strategy regards to the link between standardization and national R&D. To this end, it is important to encourage researchers to get involved in the standardization process, and to incorporate standardization into R&D projects as an integral part. In terms of the evaluation of the performance of strategic and implementation plans, the following performance indicators can be considered: the degree of engagement in standardization measured in both qualitative and quantitative methods, development of standards in terms of numbers and the ability to meet stated needs, and the access to standards documents and other channels of dissemination.

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PART
01

INTRODUCTION

Chapter 1. Introduction

1.1. Background

Amid the growing integration of the global economy, international trade is considered a powerful engine of economic growth across the globe. Standards as a common language which make goods and services exchangeable and compatible in the global market are a key element to an economy's international trade promotion objectives. For consumers, standards lower the transaction costs of information on products, processes, and services in the global market, as they convey such information in a consistent and predictable form (Stephenson, 1997). For producers, adoption of standards enhances productivity efficiency by leading to economies of scale and lowering production costs per unit, thereby increasing their competitive strength. Moreover, standards, as an embodiment of technology, can spur and disseminate innovation by providing information on new technologies across the national borders (World Bank, 2011).

On the other hand, differing national standards systems pose the danger of standards acting as an unnecessary obstacle to international trade. The development of WTO Agreement on Technical Barriers to Trade (hereafter TBT Agreement) in the World Trade Organization (WTO) regime was one recognition to reduce such incidence of standards and technical regulations as being used as technical barriers to trade between countries (UNIDO & ISO, 2008).

In the Asia-Pacific region, with its intra-regional exports and imports growing robust at an average of 8.1 per cent per annum since 1992, there have been efforts to promote integration of the regional economy and to reduce the technical barriers to trade on a regional basis (DFAT, 2013). Recently, the *2013 Asia-Pacific Economic Cooperation (APEC) Leaders' Declaration* adopted in Bali, Indonesia recognized *"the increasing need for more efficient flow of goods, services, capital and people"* in the Asia-Pacific region, and reaffirmed the regional commitment to promote "*physical, institutional, and people-to-people connectivity*" (APEC(a), 2013). The importance of standards in achieving these goals is immense: standards are a key policy tool to ensure the connectivity and interoperability of physical infrastructure across the region as well as to form and implement regionally-shared *good regulatory practices* at the institutional level (APEC(b), 2013; APEC(c), 2013).[1]

Prior to the 2013 Leaders' Declaration, the APEC "Declaration on a Standards and Conformance Framework" in 1994 recognized the important role of standards in trade

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[1] APEC 2013 Leaders' Declaration sets out three optional tools to develop, use, or strengthen the implementation of the Good Regulatory Practices including: 1) single online locations for regulatory information; 2) prospective regulatory planning; and 3) periodic reviews of existing regulation. For more information, see: *"Support for good regulatory practices in APEC will foster growth"*, 27 June, 2013, Medan, Indonesia, APEC Subcommittee on Standards and Conformance, http://www.apec.org/Press/News-Releases/2013/0627_growth.aspx

facilitation, and sets out guidelines for each economy to align their national standards with international standards. Built upon the Declaration, the Sub-Committee on Standards and Conformance (SCSC) was established in the same year to "reduce the negative effects that differing standards and conformance arrangements have on trade and investment flows in the Asia-Pacific region"[2]. The SCSC aims for greater alignment of APEC member economies' standards with international standards, and thereby for the promotion of open regionalism and market-driven economic interdependence (APEC SCSC, 2005).

Even though this initiative has achieved a certain degree of success, there was a general lack of knowledge sharing among APEC member economies in this regard. Since many of standardization activities were performed separately by each economy, information on national standardization activities were not efficiently and effectively shared within the region. Consequently, problems such as duplicate investment on similar standardization works, and blockage of information flow and service transfer may happen and have occurred. Moreover, due to the different characteristics of standards infrastructure in, and standardization capacities of, the APEC member economies, it is difficult to generate a systematic reference material to share and learn about standardization policies and activities across the region.

1.2. Purpose of the report

Against this backdrop, the *APEC Guideline on Standards Infrastructure Establishment* aims to provide a source of reference on standardization activities within the region, by describing and analyzing the standards infrastructure of the APEC economies, and providing a set of recommendations to achieve greater alignment of national standards infrastructure among the APEC economies.

In this report, "*standards infrastructure*" is suggested as a concept to describe a comprehensive ecosystem of standards and standardization activities in an economy, which encompasses the physical environment, institutional context, human and organizational actors as well as their interactions. Previously, there were not many attempts to coin an umbrella term that describes the entire ecosystem of standards-related activities. The term standards infrastructure is rarely found in standards literature, and if any, it views standards as part of the national economic or industrial infrastructure, rather than looking at what constitutes such infrastructure.[3] In this sense, it is believed that the concept as an analytical framework for assessment and comparison constitutes a contribution of the report, combined with an in-

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[2] For further information on the establishment of the Sub-Committee on Standards and Conformance, see:
http://www.apec.org/Groups/Committee-on-Trade-and-Investment/Sub-Committee-on-Standards-and-Conformance.aspx
[3] For example, Swann (2000) described standards as "soft infrastructure for innovation-led growth" (Swann, 2000, p.13).

depth analysis of its components in 15 APEC economies.

Drawn from a spectrum of standards-related policy areas that are being practiced in APEC economies, the term standards infrastructure is defined as *"systems, facilities, environments, information, and human resources to support and facilitate standardization activities, including, inter alia, the development, adoption, and utilization of standards"*. In particular, this report investigates related government policies and programmes of APEC economies on the following five issues: 1) organization of national standardization bodies (NSBs), 2) budget for standardization activities, 3) implementation and dissemination of standards, 4) standards professionals, and 5) standardization strategy and performance.

In order to understand and compare similarities and differences of standards infrastructure in the APEC economies, this research has employed a combination of methods including a survey, literature review, and in-depth group discussions among experts. The group discussions were conducted during a workshop held in Medan, Indonesia on 23 June 2013.[4] This report is an outcome of an almost year-long deliberation and data collection with experts of the national governments, private sector, international organizations and academia, particularly focused on the 15 participating economies in the APEC-wide survey including Australia; Canada; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Peru; the Philippines; Singapore; Thailand; the United States; and Viet Nam.

1.3. Project history

This project began as one of the APEC SCSC projects, CTI 15/2012A, "Creation of APEC Guidelines on Standards Infrastructure Establishment". It was proposed by Korea and co-sponsored by eight economies of China, Indonesia, Japan, Malaysia, Peru, Singapore, the United States, and Viet Nam. This one-year project aims to build a common understanding of standards infrastructure among APEC economies and to examine how an economy can set up sound standards infrastructure based on the other economies' trials, experiences and errors.

In part of the project, the Standards Infrastructure Survey (hereafter *SI Survey*) was conducted. The *SI Survey* consists of a total of 15 open-ended questions; there are three questions under each of the five categories defined in the previous section: organization of NSBs, budget for standardization activities, implementation and dissemination of standards, standards professionals, and standardization strategy and performance. A wide range of valuable information was collected from participating economies. Those survey results from the 15 survey-participating economies have become the main source of this guideline, along with the information gathers in the workshop help in June 23, Medan, Indonesia.

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[4] Further information on the history of the project is provided in the following section.

1.4. Structure of the report

This report consists of three parts. Part I contains this introductory chapter. The following Part II consists of five chapters, Chapters 2 to 6, which are organized according to the five key issues in the survey. Chapter 2 examines the system and structure of national standards development in the APEC economies, including the organization and characteristics of NSBs, the supporting and collaborating organizations to NSBs, and the technical committees. In Chapter 3, an analysis on the budgets to support standardization activities is presented, focusing on the challenges to the business model of NSBs. In Chapter 4, this report touches on the implementation and dissemination of standards, regarding the translation of national standards into technical regulations, and the mechanisms of product and management system certification. Chapter 5 presents an analysis of human resource development for standardization, as to how the APEC economies nurture experts for public and private standardization activities and what incentives are offered for their accomplishments. Chapter 6 addresses the strategic planning for national standardization activities, notably including the essential link between the economy's R&D and standardization. In Part III, Chapter 7 summarizes the previous chapters and presents guidelines to better align different national standards infrastructure within the APEC region. In the final Chapter 8, concluding remarks are presented which address the limitations of this report and suggestions for further research.

PART
02

STANDARDS INFRASTRUCTURE ANALYSIS

Chapter 2. Organization

An economy's national standards infrastructure may take a variety of forms in terms of its governance structure, funding methods, operational management, and stakeholder relations. These variations in the institutional configuration reflect the distinct context of the economy, ranging from the history of its economic and industrial development and the changing global economic climate to the industrial competitiveness and the richness of its professional societies (O'Sullivan & Brévignon-Dodin, 2012). In this sense, looking at the institutional dimension of the national standards infrastructure gives a good starting point to understand its entire landscape.

It is well-documented in the literature that **approaches to institution- building of standards infrastructure** can be broadly divided into two groups (Stephenson, 1997; Fraunhofer ISI, 2007; UNIDO & ISO, 2008; O'Sullivan & Brévignon-Dodin, 2012). On one hand, there is a highly **decentralized**, private-led approach as exemplified in the case of the United States. The American model is characterized as *"an informal, flexible bottom-up approach"*, with a particular strength in responding to the unexpected shifts in the global market and the rapid advancement of technologies (Ernst, 2012). On the other hand, standards development activities have traditionally been much more **centralized** in other economies (Stephenson, 1997). Markedly, this government-led approach is more advantageous to coordinate and prioritize competing interests of standardization for the maximum benefit of the economy (O'Sullivan & Brévignon-Dodin, 2012; Ernst, 2012).

Besides, t**he national standardization body (NSB),** while its role is still defined within the context of the particular institution-building approach, serves as a cornerstone of the national standards infrastructure. Even though economies do have differing priorities, previous research works have identified several **core functions of an NSB** such as developing standards, supporting the implementation and use of standards within an economy, liaising with international, regional or sub-regional standards bodies as a national representative, and raising awareness of the public on the value of standards (Stephenson, 1997; Swann, 2001; UNIDO & ISO, 2008). Over the years, **new priorities** have also emerged. Notably, **the coordinating role** of the NSB has turned into one of its central tasks regardless of whether the economy takes a government-led or a private-led approach – for example, by correcting the typical imbalance in participation in the creation of standards as well as orchestrating different stakeholders' voices and activities (Swann, 2010; O'Sullivan & Brévignon-Dodin, 2012). Additionally, an NSB is increasingly expected to serve as a facilitator of the global trade by harmonizing national standards and technical regulations with international practices, and thereby reducing the incidence of standards becoming technical barriers to trade.[5]

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[5] Refer to the WTO TBT Annex 3 "The Code of Good Practice for Standards Bodies." To access: http://www.wto.org/english/docs_e/legal_e/17-tbt_e.htm#annexIII

Against this backdrop, this chapter examines how each economy's standards infrastructure is organized from the institutional perspective, with a particular interest in the formation and functions of an NSB and its supporting organizations. For this purpose, the *SI Survey* asked the following three questions:

1.   What is your National Standards Body? And what are its characteristics?

2.   What are the supporting or collaborating organizations of NSB in terms of implementing standardization policy or standards development?

3.   How are technical committees organized? And how many are they? How many experts participate in technical committee activities?

This chapter is organized according the above three questions. In the section 2.1, the responses from the participating economies in terms of the organization of their NSBs are presented. In contrast to the analyses of the other domains in the *SI Survey* throughout this report, this section sets out existing discussions on the strengths and weaknesses of the two institution-building approaches of standards infrastructure mentioned earlier. It will give policymakers an opportunity to reflect on their own systems and amend some aspects, if necessary. Section 2.2 addresses the supporting and collaborating organizations of NSBs with a focus on how to ensure their engagement. Next in section 2.3, the roles and significance of technical committees are presented along with discussions on how to achieve a balanced participation of stakeholders in their formation.

2.1. Nature and characteristics of National Standards Body

As mentioned in the beginning, there are two types of NSBs; an NSB as a private entity or as a government agency. Table 1 lists the NSBs and the supporting /collaborating organizations of the 15 participating economies of the *SI Survey*. Of the 15 economies, the NSBs of ten economies are government agencies, while the NSBs of two economies, the United States and Australia, are private in nature. The NSBs of Canada and New Zealand are Crown corporations, which enjoy a unique quasi-public statute.[6] Hong Kong, China does not have an NSB.[7]

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[6] In Canada, crown corporations operate at arm's length from the government, but they are owned by the state and are accountable to the government as public institutions through the minister responsible for that corporation. They play a key role in satisfying the government's need where the private sector does not have the will or the capability to provide services necessary for national interest (Treasury Board of Canada Secretariat, 2005). Similarly in New Zealand, Crown entities have been created by specific acts of the Parliament and each crown entity has a responsible minister. They are organizations that are a part of the state sector of New Zealand (Laking , 2012).

[7] Even though the Innovation and Technology Commission (ITC) serves as a window for standards-related external collaboration, Hong Kong, China does not have a central standards body that develops and issues standards. It is a general practice that regulatory bureaus and departments adopt and use international and regional standards as and when necessary.

[Table 1] NSBs and supporting/ collaborating organizations of the participating APEC economies

Economies	NSB	Nature	Supporting/collaborating organizations
1. Australia	Standards Australia http://www.standards.org.au	Private	- Standards Australia Council, which elects the Board of Directors, the Accreditation Board for Standards Development Organizations (ABSDO) and appoints new Members to the Standards Australia
2. Canada	Standards Council of Canada http://www.scc.ca	Federal crown corporation*	- Six standards development organization (SDOs) accredited by SCC develop standards in Canada that meet Canadian requirements
3. Hong Kong, China	There is no NSB**	Not applicable	- Innovation and Technology Commission (ITC), a government agency, serves as a window for external collaboration for standards-related matters http://www.itc.gov.hk
4. Indonesia	National Standardization Agency of Indonesia (BSN) http://www.bsn.go.id	Government agency	- Indonesian Standardization Society (MASTAN), an open, independent organization whose members have the rights to give comments on draft national standards
5. Japan	Japanese Industrial Standards Committee https://www.jisc.go.jp/eng/	Government agency	- More than 300 organizations including the Japanese Standards Association (JSA) are appointed by JISC to develop Japanese Industrial Standards (JIS)
6. Republic of Korea	Korean Agency for Technology and Standards www.kats.go.kr	Government agency	- Korean Standards Association (KSA), a private and non-profit organization entrusted by the government - Co-operation Organization for Standards Development (COSD), private standardization agency designated by KATS
7. Malaysia	Department of Standards Malaysia http://www.standardsmalaysia.gov.my/	Government agency	- SIRIM Berhad, a Standards Development Agency (SDA) appointed by Standards Malaysia to develop Malaysian Standards (MS) - 16 Standards Writing Organizations (SWOs) assist SDA - Smart Partnership Programme, appointed by Standards Malaysia
8. Mexico	National Bureau of Standards (Dirección General de Normas, DGN) of the Ministry of Economy http://www.economia.gob.mx/standards_	Government agency	- National Standardization Commission (CNN): DGN serves as the technical secretary to CNN, which approves the National Standardization Programme and its supplement, and issues recommendations on the whole system. - SDOs are entities registered by the DGN to elaborate and issue Mexican Standards.
9. New Zealand***	Standards Council of New Zealand http://www.standards.co.nz/	Autonomous crown entity*	- Standards New Zealand is a self-funded, not-for-profit organization, which serves as the operating arm of the Standards Council, - Ministry of Business, Innovation and Employment is a central government agency responsible for undertaking policy work on the contribution of standardization

10. Peru	National Institute for the Defense of Competition and Protection of Intellectual Property (INDECOPI) http://www.indecopi.gob.pe/0/home.aspx?PFL=1	Government agency	- INDECOPI creates national technical committees under the responsibility of an institution such as a public agency, a private association, or a university, etc. to serve as a secretariat to the development of standards in specific areas
11. The Philippines	Bureau of Product Standards (BPS) http://www.bps.dti.gov.ph/activities.html	Government agency	- 4 supporting organizations including: - Bureau of Agricultural and Fisheries Product Standards (BAFPS) under the Department of Agriculture - Oil Industry Management Bureau (OIMB) under the Department of Energy - Energy Management Bureau (EMB) under the Department of Environmental and Natural Resources - Center for Device Regulation, Radiation Health and Research (CDRRHR) under the Department of Health
12. Singapore	SPRING Singapore http://www.spring.gov.sg	Government agency	- Singapore Standards Council, appointed by SPRING Singapore, a private-led Council to assist and advise SPRING Singapore on the strategies, policies, procedures and implementation of the Singapore Standardization Programme.
13. Thailand	Thai Industrial Standards Institute (TISI) http://www.tisi.go.th	Government agency	- Six MOU partnership institutes including: - Department of Alternative Energy Development and Efficiency - Department of Industrial Works - The Engineering Institute of Thailand - National Electronics and Computer Technology Center (NECTEC) - The Federation of Thai Industries - The National Nanotechnology Center (NANOTEC)
14. The United States	American National Standards Institute (ANSI) http://www.ansi.org	Private, non-profit organization	- 220 distinct entities currently accredited by ANSI to develop and maintain nearly 10,000 American National Standards (ANS).
15. Viet Nam	Directorate for Standards, Metrology and Quality of Vietnam (STAMEQ) http://en.tcvn.vn/	Government agency	- The Vietnam Standards and Quality Institute (VSQI) is a subsidiary of STAMEQ that is responsible for organizing national technical committee activities; developing and publishing national standards, and providing other related services. - Co-operation Organizations for Standards Development (COSD) from Ministries and Ministry-level Agencies to organize the development of Vietnam Standards (TCVNs) in their specific fields assigned by the Government.

* See footnote 6 for more information on their legal status.

** See footnote 7 for more information on Hong Kong, China's standards related practices.

*** See footnote 13 for more information on the planned changes on the New Zealand's NSB.

NSB as a private entity

The United States illustrates a case where a private entity assumes the responsibility of a top-level NSB. In the United States there is no formal NSB with the authority to direct standardization activities of the economy. Instead, the American National Standards Institute (ANSI), a private, non-profit membership organization founded in 1918, represents the American standards infrastructure and its constituents domestically and internationally. It is noteworthy that the roles ANSI plays as an NSB is tailored to suit the "voluntary standards system" of the economy, which is focused on "voluntary consensus standards that are created by private-sector standards development organizations" (Ernst, 2012, p. 2), which, in turn, is considered to be deeply embedded in "American political culture and manner in which industrialization took place in the United States" (OTA, 1992, as cited in Ernst, 2012, p. 3). As noted, strong decentralized industries have contributed to the establishment of more than 400 separate standards development organizations for the economy's industry (UNIDO & ISO, 2008).

Accordingly, ANSI does not develop standards itself but serves as the administrator and coordinator of the standards infrastructure by coordinating the creation, promulgation and use of standards among its members. To make this possible, ANSI enjoys supports from a diverse constituency of private and public sector organizations including U.S. and international companies, associations, standards developers, conformity assessment bodies (such as labs, certifiers, inspection bodies, etc.), government agencies, and non-governmental organizations. With this broad-based support, standards documents published by ANSI are widely used by industry and governments. In addition, ANSI is formally the sole representative of the interest of the United States in international standard development fora such as ISO/IEC (Ernst, 2012).

NSB as a government agency

In economies where the NSB is a public entity, the forms and functions of NSBs still vary by their legal status in the government. For example, NSBs in Korea and Viet Nam are stand-alone government agencies in purview of specific ministries or departments of the government, while NSBs of Japan and Thailand, respectively, are a committee and a department within their ministerial structure. In terms of the function, some NSBs directly and specifically cover the development of national standards as their responsibility, for instance, in Indonesia (BSN), Malaysia (DSM), the Philippines (BPS), and Thailand (TISI). Whereas NSBs in other economies such as Japan (JISC), Korea (KATS), Mexico (DGN), Peru (INDECOPI), and Singapore (SPRING SG) stress their roles to formulate and manage the overall standards development system and tend to delegate the task of developing standards to separate standards development arms which are under the supervision of the

NSB, for instance JSA/Japan and KSA/Korea.[8]

Despite these variations, however, NSBs of governmental nature share certain characteristics. Many of them are established and operated based on specific legal grounds, for example, a presidential decree in the case of Indonesia, a standards act in Viet Nam, and a federal law in Mexico. In addition, these NSBs tend to be supported by separate implementation organizations; they are usually private or nonprofit in nature, specialized in executing standards policies and putting them into effect, for example, by developing and distributing specific national standards. The supporting/ collaborating organizations to the public NSB will be discussed further in the following section 2.2.

From the *SI Survey*, the Korean Agency for Technology and Standards (KATS) shows an example of an NSB as a government agency. KATS was established based on the Industrial Standardization Act (1961) and enhanced by the Framework Act on National Standards (1999), and is currently aligned under the Ministry of Trade, Industry and Energy. The Agency is mandated to set out and implement policies regarding national standardization, conformity assessment and legal metrology by managing the Korean Industrial Standards (KS), coping with regulations on technology, and managing product safety, among others. KATS does not directly develop national standards, but serves as a control tower of the economy-wide efforts to develop and promote standards in collaboration with specialized partner/supporting organizations to carry out plans and policies. On the international front, KATS collaborates with, and represents the economy at, international and regional standards organizations such as ISO, IEC and APEC SCSC.

Comparisons

As mentioned in the beginning, the way an economy's standards infrastructure is established is ingrained in the history and culture of the economy's industrial development as well as the economic circumstances surrounding it. Naturally, the characteristics of an NSB are shaped to cater for the specific and unique needs of the economy, and remain open to ongoing changes. In this sense, there is no single model or the best practice in the institution-building approaches of standards infrastructure. In a nutshell, the merits and demerits of decentralized and centralized models of NSBs can be summarized as below.

First, the NSB as a private entity may perform well in a decentralized, market-oriented model, through which industry actors can respond quickly to the changing market and technological conditions. In such a private-led standards infrastructure, companies have greater incentives for risk-taking, which is believed to be a driver of bottom-up innovation. Additionally, a private NSB may have more flexibility compared to a public one, for example, in terms of the administration, financing, and operation. Conversely, the coordinating, not governing, nature of a private NSB, which defines the potential advantages of the decentralized approach, may

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[8] Further explanations on these supplementary organizations to NSB are given in 2.2.

also lead to conflicts and competition among stakeholders and weaken the general effectiveness of the standards infrastructure (Ernst, 2012). Moreover, to make this system really work in practice, the existence of a strong private sector and a network of professional society are a precondition, rendering it difficult to be emulated in economies with relatively weak industrial and technological foundations.

On the other hand, the NSB as part of the economy's government machinery is advantageous to develop and manage a centrally controlled standards infrastructure. Such an NSB can easily spearhead and coordinate various standardization activities and strategically allocate resources to priority areas, taking into account of the economy's industrial competitiveness and prevailing R&D needs (Stephenson, 1997). Furthermore, the government-led approach is particularly competent in times when the private and public interests are not in balance; an NSB as an official arm of the government may exert greater authority over the direction and move it towards fulfilling the public good nature of standards. On top of that, an NSB under the centralized system operates on a relatively predictable, secure inflow of public funds, making it easier to plan on a longer-term. However, there are shortfalls in the centralized model. An NSB as a public agency suffers the relative lack of flexibility and resilience, which is critical to agilely adapt to the shifts in the global market as well as the evolution of technology. Another frequently cited demerit of the top-down approach concerns the risk of the government excessively enforcing the "requirements" that services and products must meet in an economy.

Last but not least, it is important to point out that these characteristics of the NSB and its organizing principle, either private-led or government-led, are closely linked to other aspects of an economy's national standards infrastructure, including the funding and budget, implementation and dissemination, and strategic planning. These issues will be further discussed in the following chapters dedicated to each topic.

2.2. Supporting and collaborating organizations for policy implementation and standards development

As mentioned in 2.1, when an NSB is a government agency, it tends to have an operational arm typically as a non-profit private institute. Depending on the organization of national standards infrastructure of the economy, the operational arm may or may not involve standards development organizations (SDOs) designated /accredited by the NSBs. For instance, Japanese Standards Association (JSA)/Japan, Korean Standards Association (KSA)/Korea, Mexican National Society of Standardization (NORMEX)/Mexico, Viet Nam Standards and Quality Institute (VSQI) are private, subsidiary organizations to their respective NSBs, which themselves are directly or indirectly involved in the development of standards on behalf of their NSBs. Box 1 describes how they work in Korea.

On the other hand, the case of ANSI/U.S. provides an example where the NSB as a private

organization promotes an open environment to encourage participation of stakeholders in the standards development (Box 2).

<Box 2> The United States: Supporting Organizations to NSB

ANSI administers the American National Standards (ANS) process, which refers to a voluntary designation selected by accredited standards development organizations (SDOs) based on the needs of the industry. Within this context, ANSI accredits more than 225 standards developers whose scopes of activity span virtually all sectors and industries. In addition, ANSI approves consensus standards submitted by these SDOs as American National Standards and regularly audits standards developers' performance.
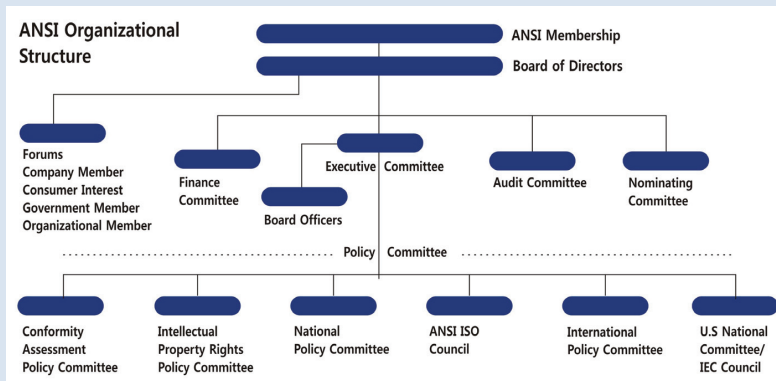
Members of the ANSI federation include academia, individuals, government, manufacturers, trade associations, professional societies, service organizations, standards developers, consumers, and labor interests. All of these stakeholders participate and contribute to the U.S. system in the development and implementation of standardization and related policies. The following chart shows the roles of various stakeholders in the U.S. system:

	ANSI	Standards Developers	Companies	Consumers	Government	NIST
Coordinates U.S. system and Policy development	X					
Independently runs standards Development activities		X				
Coordinates and monitors USG use of and participation In VCS activities						X
Legal metrology and WTO-TBT enquiry point						X
Provides technical input for Standards development			X	X	X	X
Participates in U.S. policy development	X	X	X	X	X	X

For more information on the ANS Process, see: www.ansi.org/ansvalue and www.ansi.org/asd

In both cases, a key to the successful supporting activities for the NSB entails engagement and participation of stakeholders and experts.

To this end, it is important to create and formalize a number of different avenues of participation. Markedly, standardization committees as a main conduit for engagement should be promoted to bring in more technical experts from diverse and related areas. For example, KATS/Korea has established specific structures for engagement such as the Technical Councils, which formalize the avenue of participation so that experts may easily gain information on opportunities for participation and find greater incentives for engagement.

Additionally, developing Memorandum of Understandings (MoUs) with private sectors, industry bodies, government departments and academia will bring about recognition of primacy for standardization in specific sectors, which in turn, may generate further interests from the media or political arena. On the informal side, policymakers may consider tapping into the network of professional societies or expert associations. A good example can be found from the BSN/Indonesia, where MASTAN (Indonesian Standardization Society) as an open, independent organization provides a formal link of participation by granting its members the rights to give comments on draft national standards.

In terms of information outreach, it can be considered to hold more general engagement events and to co-locate standards committee events with scientific conferences, and along with other promotional activities in order to provide an easier access to 'taster courses' to technical experts (Fraunhofer ISI, 2007). It is also important to maintain an ongoing communication channel between the NSB management and the stakeholders including the technical experts. Policymakers may consider employing market intelligence such as periodic surveys and market research reports to understand the sector-specific needs, as well as the perception of effectiveness of the NSB regarding the standards development process.

2.3. Technical committees

Generally speaking, standards are developed by groups of experts within technical committees (TCs) (ISO, 2013). Considering that standards encapsulate accumulated knowledge and expertise on a subject, TCs, each of which deals with different subject matters, are where such encapsulation of knowledge actually takes place (BSI, 2013). In this sense, it is important to compose TCs in a transparent and inclusive manner, with a balanced representation of stakeholders, including industry, NGOs, governments, and others.

For the most part, the result of the *SI Survey* and the Medan Workshop stressed the importance of creating and maintaining balanced TCs that bring in the right expertise while no single interest dominates the deliberation process and that operate on the principles of impartiality and consensus.

To illustrate, SCC/Canada spells out key principles of standards development processes that

should be adhered by accredited SDOs regarding the representation and selection of committee members, consensus-based decision-making methods, documentation of progress, and the requirement of disclosing the draft documents for public review.[9] Similarly, SA/Australia has documented a series of standardization guides which set out the standard procedure of standards development.[10] The guides specifically cover the composition, structure, and organization of standardization committees as well as the roles and responsibilities of their members, i.e. TC chairs, secretaries, and TC members.

Nonetheless, there are also notable differences in the way TCs are organized, reflecting the different characteristics of the economy's standards infrastructure.

On one hand, in economies where the NSB is a government agency, it is considered one of the key roles of the NSB to set out guiding principles to organize TCs. In many economies, multi-tier committees are formed to ensure the technical rigor and transparency as well as the inclusiveness of the decision-making; they consist of, for example, a high-level committee for approval and a TC working group for technical deliberation and standards drafting (Box 3).

<Box 3> Korea: Two-tier System of Technical Committees

Technical Council

The Technical Council makes rooms for plenary discussion and decision making on the subject, without a limitation to the number of members. A wide range of experts from various sectors join in the Council including industry, academia and research institutes. The Technical Council is responsible for the issuance, review, and revision of national standards that are submitted to the Council after the deliberation at the Expert Committee.

Expert Committee

In the Expert Committee, stakeholders discuss and collect opinions on the technical details regarding the establishment and revision of national standards, and create drafts. There are 370 Expert Committees and each committee is made of no more than 20 members. In addition, it is the responsibility of the Expert Committee to research data in order to harmonize national standards with international standards.

Number of Technical Councils	Number of Technical Councilors	Number of Expert Committees	Number of Experts
51	482	370	4,493

Source: 2012 Technical Standards Statistics published by KATS

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[9] For information on Standards Council of Canada's Criteria and procedures for standards and standards development organization accreditation, see:
http://www.scc.ca/en/about-scc/publications/criteria-and-procedures/standards-and-standards-development-organization-accreditation
[10] For information on Standards Australia's Standardization Guides, see:
http://www.standards.org.au/StandardsDevelopment/Developing_Standards/Pages/Standardisation-Guides.aspx

On the other hand, the TCs of standards developers based in the U.S. are independently organized and operated by the SDOs themselves. Notably, several instruments to ensure the quality of standards development are put in place, including the application of internationally compatible standards development process, board system, and regulations regarding TC composition, so as to cast aside potential concerns over the lack of rigor and fairness that may arise from the private-led decentralized approach (Box 4).

In addition to the two examples from the private and government-led approaches respectively, the SPRING/Singapore displays an interesting example of public-private collaboration to encourage stakeholders' participation in the TC activities. Here, the NSB on the government side supports the industry represented by the Standards Council, so that the industry actors can take the leadership over the contents of standards development while adhering to the fair, inclusive deliberation procedure set forth by the government. This, in turn, allows a greater room for stakeholders with diverse interests to join in the standards development process. (Box 5)

<Box 4> The United States: Technical Committees at ASTM International

ASTM International, a member organization of the ANSI/U.S. and accredited SDO, employs a standards development process that is compliant with the WTO/TBT principles for the development of international standards to run its 143 technical committees with over 27,000 participating members. By adopting an internationally recognized procedure regarding, for example, proposal, documentation and voting rules, ASTM International renders its standards development process more transparent and inclusive, as well as compatible to international practices.

Another key instrument of quality insurance involves the utilization of a board system. The ASTM Board of Directors is responsible for approving the committees' titles and scopes. Under the purview of the approved scope, the committees are organized into subcommittees and task groups. Each committee develops its own bylaws, which are subject to approval by a Standing Committee of the Board of Directors. Committees elect their main committee officers in accordance with the nomination and election procedures outlined in the ASTM Regulations Governing Technical Committees. Committees conduct subcommittee and main committee/Society review ballots on standards actions and are subject to a procedural review by a Standing Committee of the Board of Directors before final approval and publication by ASTM.

Last but not least, ASTM International applies specific regulations to assure a balanced representation of stakeholders in TCs. Membership in technical committees is open to all interested individuals and organizations. Within the technical committees, membership must be balanced as defined within the ASTM Regulations. Notably, 52% of ASTM's membership comes from SME's.

Source: *SI Survey,* 2013

<Box 5> Singapore: Singapore Standardization Programme

Under the Singapore Standardization Programme, SPRING Singapore coordinates the national standardization program under the guidance of the industry-led national Standards Council. Here, the essence of the model lies in striking the right balance of leadership between the NSB on the government side and the Standards Council on the industry side. The NSB, SPRING Singapore as a government agency holds the procedural leadership by setting out priorities, strategies, programmes and procedures. Whereas the industry-led Standards Council, which comprises experts from the private and public sectors appointed by the NSB, proactively leads the technical initiatives; it comprises multi-tier committees including the standards committee, technical committee, and working groups for each industrial sector, and approves the establishment, revision, and withdrawal of Singapore Standards.
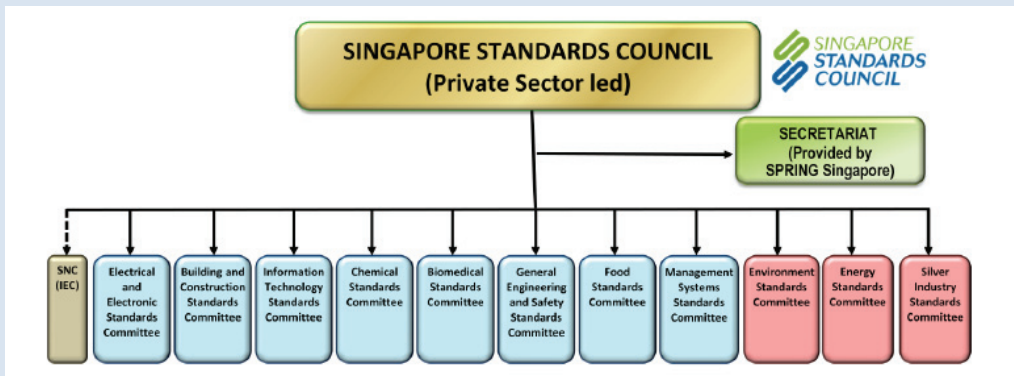
The Singapore Standards Council is appointed by SPRING Singapore to assist and advise SPRING Singapore on the strategies, policies, procedures and implementation of the Singapore Standardization Programme. The Council works with SPRING Singapore to set up relevant committees to look into specific areas of standardization. Based on the industry's and regulatory agency's requests, the Standards Council may set up new Standards Committees and Technical Committees to look into new areas of standardizations.

For further information, see:
http://www.spring.gov.sg/qualitystandards/std/pages/standards-council-standards-development-organisations.aspx

2.4. Recommendations

In brief, this section has examined how standards infrastructure is organized from the institutional perspective, with a particular interest in the formation and the functions of an NSB and its supporting organizations.

In terms of the nature of the NSBs, two major approaches to standards infrastructure development have been reviewed. In the private-led model exemplified in the U.S., the open, flexible characteristics of NSBs allow a greater room for industry participation and bottom-up innovation, whereas in the government-led model, the strengths lie in the capacity to plan and coordinate various stakeholders and their activities for the maximum benefit of the economy.

In either form, however, NSBs should be formally recognized by a legislative instrument or a governmental decision as the body most broadly representative in its economy (UNIDO & ISO, 2008). In this regard, the NSB should carry out the following functions: 1) Standards development and/or management; 2) Information provision for broader stakeholder participation, and 3) International, regional and sub-regional liaison, which include representing the national interests and harmonizing national standards with international standards.

On the procedural perspective, key issues include how to ensure participation of stakeholders in the composition of standards / technical committees and to maintain their engagement in a fair, inclusive manner without one interest dominating the entire standards development process.

To this end, NSBs should consider having quality control of the process, for example, by documenting the "standard process of standards development". As illustrated in the case of Australia, a clear set of guidelines on the principles and processes of creating and operating technical committees may be useful in this endeavor. In addition, a multi-tier deliberation system may provide a 'safety valve' to enable technical opposition or conflicting interests to be moderated by a higher level in the standardization process.

Last but not least, the public-private collaboration mechanism in Singapore through which the government supports and coordinates industry-led standards development process may provide a viable option to boost up the stakeholder engagement in this regard.

Chapter 3. Budget and Business Model

An organization needs resources in order to sustain itself. It strives to acquire and allocate scarce resources to meet the costs of fulfilling its missions (Steiss & Nwagwu, 2001). In this sense, a business model, which refers to "a design for the successful operation of a business identifying revenue sources, customer base, products, and details of financing (Oxford, 2013)" is an integral part of an organization's overall management. An NSB, likewise, develops funding sources and a business model to secure resources to achieve its goals of developing and promoting standards. Considering the pivotal role an NSB plays in the development and maintenance of an economy's entire standardization infrastructure, an investigation of the NSB's budget and its business model can be a proxy to figure out the whole economy's direction regarding the mobilization and allocation of resources for standardization.

In the existing body of literature on standards research, only a handful of papers touch on the issue of NSB financing and business model, and most of them are just supplementary to the discussion on the formation and structure of NSBs (Lynch, 1999; Swann, 2000; 2010; UNIDO & ISO, 2008; ITU, 2009). In the general scarcity of discussion, it is mostly agreed among researchers that the way in which an NSB acquires and allocates funds is closely **related to the key characteristics of the organization such as its statutes, governance structure, and core functions** (UNIDO & ISO, 2008; Swann, 2000; 2010). In some economies, regular funding from the government takes up the central part of NSBs' resources while in other economies, NSBs have their own wings of income generation, such as the sales of standards documents and the membership fees received from the private sector. Despite the varying combination of revenue streams in the business models, it was found in the workshop held in Medan, that what lies common at its core is the following two inter-related questions: first, how to **secure a sustainable, sufficient inflow of financial resources**, and; second, how to **demonstrate the value of standardization activities** to those who make funding and investment decisions, such as the parliaments and private sector businesses, etc.

Given these points, this section of the *SI Survey* probes how resources are mobilized to support standardization in an economy, how they are allocated, and what measures can be taken to secure and increase the budget for the purpose of enhancing the national standardization infrastructure. To this end, the following three questions are asked in the survey:

1. What is the budget size for national standardization (i.e. NSB's budget) in your economy? Where does it come from? How much is the standardization budget per head of population?

2. For what is the budget allocated? In other words, for what kind of activities are the budget used (i.e. standards development, training, dissemination, etc.) and how much for each?

3. Do you have any program in your economy in order to secure and increase the budget for

the enhancement of national standardization?

From the preparation stage of the *SI Survey*, however, there was a concern regarding the availability and comparability of budget data from different APEC economies, which turned out to be a real issue. In the first place, the responses gathered from the participating economies were not rich enough to make a comparative analysis, possibly due to the sensitivity concerning the national budget information. Additionally, since the budget figures from each economy varied significantly in terms of the currency, budget cycle, accounting method, and classification of budget items, it was even more difficult to accurately compare the figures and draw out meaningful implications at the regional level. Fortunately, however, the group discussions held during the workshop in Medan produced insightful discourses particularly helpful to understand the challenges facing NSBs in terms of securing budget and establishing a sustainable business model, thanks to the valuable input provided by participating experts.

Therefore the analysis in this chapter on the budget and business model, unlike that of other chapters, largely draws on the outcomes of the group discussions held during the workshop, while the result of the *SI Survey* is utilized as supplementary information.

Accordingly unlike the other chapters where sections are organized by the three questions in each section of the survey, this chapter is formed by the streams of the discussions generated in the workshop. As such, it is organized by the two types of NSBs which are identified in Chapter 2. Section 3.1 deals with the budget challenges NSBs face as a governmental or quasi-government organization and it is followed by the challenges faced by privately-funded NSBs in section 3.2. Then, a summary of discussion and recommendations are provided.

3.1. Budget challenges of public NSBs

As seen in Chapter 2, NSBs in most of the participating economies are government agencies. Generally speaking, the funding for such an NSB comes from two sources: **regular government funding** and **commercial funding** in relation to activities such as testing and certification, training, consultancy, sales of standards and publication, etc. (UNIDO & ISO, 2008). It is natural that NSBs, depending on the specific conditions they have such as the legal status and governance structure, have their own mix of income streams and business models which are subject to different sets of opportunities and challenges.

The participants of the workshop shared a concern that **securing and sustaining the budget** for standardization activities is one of the most significant difficulties facing NSBs, regardless whether an NSB is funded completely or partly through the government.

Some of the common budgetary challenges include:

- Appealing to the Parliament or the authority in charge for sufficient funds

- Justifying the importance of the NSB's role and the value of standardization among other national priorities
- Securing industry's interest and support for standards activities

The workshop participants indicated that there is a general lack of recognition of the national importance of standards in the government, which leads to assigning a lower priority to standardization activities in the national budgetary decisions. As a governmental or quasi-governmental institute, NSB's budget is decided by the budgetary authorities in the government, for example, the Parliament. Frequently, however, due to the invisible, abstract and technical complexities of standards, government officials and parliamentarians are not familiar with the role of standards in national economic competitiveness, innovation policy, as well as public interest concerns (ITU, 2009). For this reason, it becomes important to demonstrate and justify the value of public investments in standards against competing priorities.

Prioritizing the standards development in the economy's national agenda

The *SI Survey* responses from Canada, Malaysia, and Peru present interesting cases of prioritizing the standards development in the economy's national agenda.

In Canada, for example, standardization has been established as a federal priority in the economy, which has allowed the Standards Council of Canada (SCC) to secure a budget increase to its base funding as of April 2012. It is considered as a success of SCC's advocacy efforts towards the federal government by highlighting the needs to strengthen and modernize Canada's standardization infrastructure, establish a stronger Canadian voice in international standards development, and support the use of appropriate standards in Canadian regulations and in trade negotiations.

The case of Standards Malaysia (SM), the Malaysian NSB fully funded by the government, provides another case in point where the goal of strengthening the national standardization infrastructure is successfully incorporated in the national priority agenda. Malaysia is currently pursuing the Strategic Reform Initiatives (SRIs) in part of its comprehensive Economic Transformation Programme. Among the 37 policy measures of the SRIs recommended by the National Economic Advisory Council, support for standards is listed under the Competition, Standards, and Liberalisation (CSL) SRI.[11] Championed by the Ministry of Science, Innovation and Technology (MOSTI), the standards component of CSL sets out a comprehensive action plan to improve the entire standards eco-system in the economy including the roles and responsibilities of key stakeholders and the specific prioritized areas of application (Box 6).

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[11] For more information on the SRIs, see:
http://etp.pemandu.gov.my/International_Standards_-%E2%97%98-_Liberalization-@-Competition,_Standards_and_Liberalisation_(CSL).aspx

<Box 6> Malaysia: Strategic Reform Initiative on Competition, Standards and Liberalization (CSL)

The Competition, Standards, and Liberalization (CSL) of the Strategic Reform Initiative in Malaysia is an excellent case of raising the profile of standardization through a national-level development agenda.

In addition to the championing role of Standards Malaysia and MOSTI, various agencies such as the Ministry of International Trade and Industry (MITI), Ministry of Agriculture (MoA), Ministry of Health (MoH), Ministry of Domestic Trade, Consumerism and Cooperatives and the Energy Commission are involved in promoting standards usage, with the enforcement of mandatory standards to be undertaken by the respective regulatory bodies.

Sectoral Initiatives

The development and usage of standards for the National Key Economic Area (NKEA) of Agriculture focus on benchmarking Malaysia's agricultural practices against international standards such as Good Agriculture Practice (GAP). These efforts are centered on standards usage in areas including aquaculture, premium fruit production and processed food.

In the health sector, the enforcement of standards in the Healthcare NKEA aims to strengthen the competitiveness of the healthcare sector by ensuring that hospitals, laboratories and research facilities are audited and certified, and that their accreditation status is maintained to sustain high quality standards. In view of this, MoH has implemented an accreditation programme for MoH hospitals, overseen by the Malaysian Society of Health for Quality in Health (MSQH). Notably, the Healthcare NKEA adopted six medical device standards and implemented eight mandatory standards. This brings the number of standards adopted since 2005 to 381, with another 14 standards currently under development. Mandatory device registration to ensure safety and quality of devices is targeted to begin in October 2014.

The Business Services NKEA encompasses a large number of industries and professions that support the growth of the economy. The focus on standards for this NKEA is to establish the framework for green labeling and the certification of cyber security facilities and products. First, the development of the green industry has been driven by growing awareness and demand for sustainably produced products. Green labeling certifies that a product meets quality and export requirements while providing consumer assurance of sustainable production processes. Second, the CSL SRI for cyber security initially focuses on standards required to protect sensitive and valuable information and services. The initial thrust of this initiative is to ensure that Critical National Information Infrastructures (CNIIs) comply with information security standards such as ISO/IEC 27001 [Information Security Management System AND Common Criteria]. The lead agencies for this are the National Security Council and Cyber Security Malaysia, an agency under MOSTI.

Excerpted from *the Economic Transformation Programme website, Performance Management & Delivery Unit, Government of Malaysia* at:
http://etp.pemandu.gov.my/International_Standards_-%E2%97%98-_Liberalization-@-Competition,_Standards_and_Liberalisation_(CSL).aspx

In Peru, advocacy efforts are exerted to develop a law on the National Quality System, which is expected to provide a greater administrative autonomy and financial stability to the Peruvian NSB. The law is currently at the preparation stage and is expected to be passed by the Congress. It is aimed at strengthening the overall national quality infrastructure including the national standards body, National Accreditation Service, and National Metrology Service. As the Peruvian response from the *SI Survey* notes, the law is expected to provide a remarkable increase to the budget for the NSB.

In addition to exerting advocacy efforts for the government side, the NSB should seek increasing involvement of stakeholders particularly from the industry. While the legal status of an NSB as a governmental or quasi-governmental organization ensures a comparatively higher level of financial security and sustainability, it also runs the risk of neglecting the NSB's accountability towards its stakeholders outside the government. The engagement of private industry as a key stakeholder is not only imperative in a political sense, but is also advantageous from the economic perspective as the private sector may and should eventually share the costs of standards development. In this sense, NSBs should strive to secure industry's interest and support for standardization activities as an avenue of cost reduction as well as revenue generation.

For the purpose of boosting industry participation, a number of economies provide networking opportunities as well as awareness-raising activities tailored to the interests of the private sector. For example, the *SI Survey* response from Singapore illustrates that SPRING Singapore has tried to raise awareness and support for standardization through case studies that demonstrate the benefit to industry and other stakeholders. Additionally, the case of UL/United States displays an interesting strategy to actively engage with the private sector throughout the process of standards development. The UL/United States has a practice to secure buy-in and support from all key stakeholders including the regulators and industry associations, prior to the development and review of standards. By endowing the private sector with a greater share of authority in the standards development process, such a practice encourages more participation from the industry as well as helps ensure the adoption and implementation of standards when they are completed.

3.2. Budget challenges of non-public NSBs

At the Medan Workshop, it was noticed that when an NSB is **funded privately,** some of the common budgetary challenges may include:

- Reliance on a single or limited revenue source
- A low level of awareness of the importance and value of standards activities

First of all, the workshop participants stressed the importance of **revenue diversification**, particularly the need to avoid relying on the sales of standards as the single most important

source of income. As a UNIDO & ISO report indicates, income from the sale of standards document typically represents a major income stream for an NSB; in some economies, such income represents more than 50% of the total income (UNIDO & ISO, 2008). This coincides with the results of the *SI Survey* showing that the sales of standards take 58% in New Zealand and 59% in the United States of their budgets respectively. As seen in these cases, a significant portion of non-public NSB's revenue comes from the sales of standards publications.

Particularly, the **pricing decision of standards documents** warrants further attention. Standards are "a form of public good (Lynch, 1999)" which represents "the distilled wisdom of experienced leading technical experts (UNIDO & ISO, 2008, p. 74)" and, more increasingly, a networked good since the public as users "tend to benefit when other users join the standard (Stiller, et al., 2010, p. 37)." Therefore, the high prices and the restrictive distribution practices of standards sales may impede the access to standards and even undermine the value of standards as public, networked goods.

In relation to this understanding, on one hand, there is a growing recognition among SDOs that the advancement of Internet and electronic commerce makes it ever easier to access online publications at virtually no cost, thus making the sale of publications an increasingly unprofitable business model. In reality, on the other hand, the difficulty lies in the situation that the sales of standards documentation are too significant to replace for many SDOs. As the *SI Survey* response from the ANSI/United States notes, many SDO's in the economy still resort to the sales of standards documents as their main revenue sources due to the lack of alternatives. This needs to be addressed in the near future.

In order to diversify the funding source for an NSB, the following can be considered; product and system certification, provision of trainings, consultancy and other services, and subscription fees from industry members. In addition, NSBs may consider supplying the texts of technical regulations in relation to the WTO/TBT, or even developing interpretive materials and tutorials for standards by further adding values (UNIDO & ISO, 2008). Here, it is important to note that **the success of income diversification** depends not only on the sales strategy and capacity of the NSBs as a provider of these goods and services, but also on the overall size, interests, and capacity of private sector as consumers of standards.

This understanding leads back to the importance of enhancing the awareness of standards and justifying standardization activities among the general public including consumers as well as various stakeholder groups. These are the topics for human resources development and education which are dealt with in Chapter 5. NSBs in Korea and Indonesia, in this endeavor, have instituted and promoted education programs that serve to raise the awareness of the importance of standardization, and also provide an alternative revenue stream for the NSB.[12]

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[12] Further discussions on the long-term education and human resources development for standards at primary, middle, and university-levels are provided in Chapter 5.

Last but not least, the financial sustainability of an NSB may even change the governance structure of an NSB. For example, in New Zealand, the Ministry of Business, Innovation and Employment (MBIE) has recently reviewed New Zealand's standards and conformance infrastructure. The review decisions among others include that a new Standards model will replace the Standards Council and Standards New Zealand, and that the task of standards development will be undertaken by an independent statutory officer within the MBIE (Government of New Zealand, 2013).[13]

3.3. Recommendations

NSBs secure and allocate their budgets to develop and promote standards. Notably, it is an important part of the NSBs' responsibilities to support stakeholders' participation in standardization activities at the national and international arenas, such as holding standards networking events, and education and training programmes domestically, and providing travel cost to attend international standardization activities, among others.

For all of the challenges noted in the previous sections, the key is how to **demonstrate the value** – either of the NSB itself or standards activities in general, or both – to the stakeholders in the government as well as the private sector. In addition, it is essential to **raise the awareness among government officials and members of Parliaments** as key decision-makers for the NSB's funding and business models. As illustrated in the cases of Canada and Malaysia, one of the best ways to achieve this mission is to incorporate the objectives of standards development into the national development agenda.

Equally, it is important to **diversify the revenue sources** of NSBs, moving away from the traditional practice which is mainly concentrated on the sales of standards documents. In some U.S.-based SDOs, another approach has been taken to set up certification businesses that may fund standards development activities. It also allows for reduced prices of, or free access to, publications, while still sustaining the organizations' budget.

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[13] The government of New Zealand has announced changes in the economy's national standards infrastructure, in order to "meet the needs of industry, regulators and consumers into the foreseeable future". A review of the New Zealand standards and conformance infrastructure found opportunities to provide a viable and well-functioning standards system which better aligns with government priorities such as innovation and trade facilitation to develop a more productive economy. In particular, the review decisions include: 1) a new standards model - with an approval function, a development function and links to the international standards community - will replace Standards New Zealand and the Standards Council; 2) standards approval will be undertaken by an independent statutory board that will provide advice to the Minister for Commerce; 3) standards development will be undertaken by an independent statutory officer within the Ministry of Business, Innovation and Employment (MBIE) and using independent committees, and; 4) the independent committees will continue to comprise industry and technical experts, consumer representatives and regulators where appropriate. For further information on the New Zealand's standards and conformance infrastructure review, see: http://www.med.govt.nz/business/standards-conformance/standards-and-conformance-infrastructure-review

Chapter 4. Standards Implementation and Dissemination

Standards are, by definition, voluntary. WTO's 'Agreement on Technical Barriers to Trade' defines standard as " (a) document approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for products or related processes and production methods, with which compliance is *not mandatory*" (italics by the authors), whereas technical regulation is defined as "document which lays down product characteristics or their related processes and production methods, including the applicable administrative provisions, with which compliance is *mandatory*" (italics by the authors)[14] (Annex 1, Agreement on TBT). And many standards are made by consensus as the Agreement particularly states, "standards prepared by the international standardization community are based on consensus".

Owing to this voluntary nature of standards, the development of standards does not necessarily mean their widespread adoption and utilization; some standards are not received well by their potential users, even undermining the legitimacy of the transparent, open and consensus-based process of standards development. National standards, just as international standards, do not automatically gain binding legal authority unless they are incorporated into legal instruments such as a technical regulation.

That being the case, the implementation and dissemination of standards, in terms of their mechanism and effectiveness, require a separate consideration apart from the standards development. A standard realizes its full potential only when it is implemented and utilized, which in turn requires a wide range of dissemination of the standard in the first place. Notably, one way to ensure a widespread implementation involves making the compliance of the standards mandatory as a technical regulation. In many economies, standards are often used to support technical regulations. Technical regulations, which refer to the "technical requirements as binding legislative rules adopted by an authority, often directly refer to or incorporate the content of a standard, technical specification or code of practice" (WTO, 2013). Provided that standards are "performance-based, developed by consensus of experts across stakeholder groups, and represent the state of the art (UNIDO & ISO, 2008, page.38)", it is likely that technical regulations based on standards are accepted well by stakeholders.

Effective it may be to widely disseminate and implement standards, however, too many applications of standards into technical regulations simultaneously run the risk of eroding the fundamental, voluntary nature of standards. Moreover, when technical regulations are based

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[14] "Standards as defined by ISO/IEC Guide 2 may be mandatory or voluntary" (Annex 1, *Agreement on TBT*). Considering that one of the primary activities of the APEC Sub-Committee on Standards and Conformance (SCSC), from which this report emanates, is to promote the compliance of WTO requirements in the Asia and Pacific region, the definitions of terms and concepts used in this report are generally adopted from the WTO publications. See the SCSC homepage for further information.
http://www.apec.org/Groups/Committee-on-Trade-and-Investment/Sub-Committee-on-Standards-and-Conformance.aspx

on national standards that are not compatible with existing international standards, it is likely that the enforcement of these technical regulations comprise technical barriers to trade (TBT). To address this concern, Article 2.2 and Article 2.4 of the WTO TBT Agreement stress that WTO members "shall ensure that technical regulations are not prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade" (Article 2.2), and that "where technical regulations are required and relevant international standards exist or their completion is imminent, members shall use them, or the relevant parts of them, as a basis for their technical regulations except when such international standards or relevant parts would be an ineffective or inappropriate means for the fulfillment of the legitimate objectives pursued, for instance, because of fundamental climatic or geographical factors or fundamental technological problems" (Article 2.4).

In addition, the implementation of standards as technical regulations also entails certain conformity assessment procedures such as a certification[15] and testing, in order to "confirm that products fulfill the requirements laid down in regulations and standards (WTO, 2013)". Similar to the application of standards, the WTO TBT agreement sets out that international guides or recommendations issued by international standardizing bodies should be used as a basis for national procedures for conformity assessment, except when they are found inappropriate due to, among others, "national security requirements, prevention of deceptive practices, protection of human health or safety, animal or plant life or health, or protection of the environment; fundamental climatic or other geographical factors; fundamental technological or infrastructural problems" (Article 5.4).

Meanwhile, it is also important to consider how NSBs disseminate standards in an effort to improve the effectiveness of standards implementation, by creating ongoing awareness and alignment among stakeholders (O'Sullivan & Brévignon-Dodin, 2012). In this regard, the online channel of information distribution has gained an increasing importance to effectively share the needs, issues, opportunities, and challenges for the widespread adoption and the effective implementation of standards.

Given that, this chapter deals with how standards are implemented through the means of technical regulations and certification systems in an economy, and explores channels for the dissemination of standards. To address these issues, the following three questions are asked:

1. What is the system of applying national standards to technical regulations in your economy?

2. What are the certification systems (product, management system) of national standards in your economy?

3. What is the system for providing standards information and disseminating national standards? How is it running? (i.e. online, offline) How much are used or sold?

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[15] Certification is very often referred to as registration in North America (ISO, 2013).

This chapter is organized according to the above three questions. For each question, an analysis of the *SI Survey* responses is presented first, followed by discussions on key issues and notable cases.

4.1. Application of national standards into technical regulations

Standards provide certain advantages to the formulation of technical regulations. In terms of the technical benefits, regulators may draw on existing best practices established in a consensus-based, open process by experts from various stakeholder groups. From the administrative perspective, the incorporation of standards lifts the burden of spelling out technical details and requirements, of which the regulators may not have sufficient knowledge.

The 15 participating economies in the *SI Survey*, in recognition of such benefits, employ various methods to facilitate the application of standards into technical regulations. For the brevity of discussion, the classification of the "governmental and private NSBs" introduced in Chapter 2 is used in the following analysis to examine how national standards are applied and translated into technical regulations in each context.[16]

When NSB is a government agency

In the economies where the NSB is established as a government agency, an overarching guideline is established to direct the process of putting a national standard, voluntary of itself, into a mandatory use, as well as to ensure the alignment between national standards and technical regulations.

In Korea, the alignment between technical regulations and national standards is achieved according to the '*Guidelines for using and referencing standards for technical regulations.*'[17] The link between the two is made clear in the text of the technical regulation by specifically quoting the relevant national standards, that is, Korean Industrial Standards (KS). Currently, over 3,000 KS are quoted in the formulation of about 2,100 technical regulations. To this end, relevant ministries that are responsible for specific technical regulations manage national standards, and submit annual reports containing the total number of quoted KSes in technical regulations to the National Standards Deliberative Committee. Such a cooperation framework further facilitates the harmonization between technical regulations and standards the other way around; a standing management body for technical regulations in each ministry serves to adequately reflect technical regulations to the establishment and revision of standards. For

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[16] As discussed in Chapter 2, the NSBs can be largely categorized into two types; one as a private entity or as a government agency. Among the 15 participating APEC economies in the *SI Survey*, most of their NSBs are government agencies except for Australia; Hong Kong, China; New Zealand;,and the United States (Table 2.1).
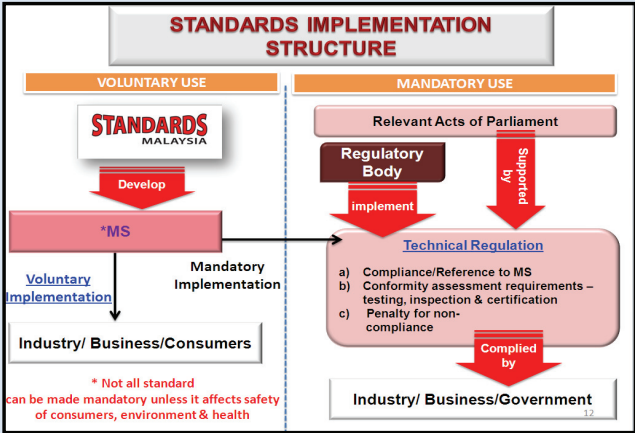[17] KS A 0014

instance, the Korean Food Research Institute is a designated cooperation body for standards development to be used as technical regulations in the food sector, on behalf of the Ministry of Agriculture, Food and Rural Affairs, while for the regulations in the communication sector, the Telecommunications Technology Association (TTA) serves for the Korea Communication Committee.

In Indonesia, the system of applying national standards into technical regulations is also described in a specific guideline[18]. In another example, the Standard Malaysia has developed "Guidelines in Referencing Standards in Technical Regulations" to enforce the mandatory use of certain national standards by establishing technical regulations (Box 7). In New Zealand, Standard New Zealand provides a guidebook for regulators covering the details of how standards are used in policy and regulation (Box 8).

<Box 7> **Malaysia: Guidelines in Referencing Standards in Technical Regulation**

STANDARDS MALAYSIA promotes Good Regulatory Practices (GRP), which refers to a set of principles which intended to provide guidelines to help efficient regulatory management for the purpose of minimizing costs and market distortion. In line with the effort, "Guidelines in Referencing Standards in Technical Regulation" is developed as a reference to the implementation of mandatory standards. The use of Malaysian Standards (MS) is voluntary except in so far as they are made mandatory by regulatory authorities by means of regulations, local by-laws or any other similar ways. The figure below outlines the implementation structures of the voluntary and mandatory Malaysian Standards.

For further information, see:

http://www.standardsmalaysia.gov.my/ms-implementation

http://www.standardsmalaysia.gov.my/documents/10179/22359/Microsoft%20Word%20-%20MS%20System%20Handbook.pdf

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[18] *Pedoman Standardisasi Nasional (PSN)* number 301 year 2011

When NSB is a private entity

Meanwhile, in economies where the NSB is a private entity, the government agencies are encouraged to adopt private-led voluntary standards as government standards.

For example, in the United State, the National Technology Transfer and Advancement Act (NTTAA)[19] directs federal agencies with respect to the use of, and participation in the development of, voluntary consensus standards. The NTTAA encourages agencies to use existing private sector standards that are appropriate for their purpose and mission wherever possible, in lieu of creating unique government standards. The Act also directs the National Institute of Standards and Technology (NIST) to coordinate the standards and conformity assessment activities of federal agencies, as well as state and local governments, with the private sector in order to reduce unnecessary duplication. In addition, the Office of Management and Budget (OMB) establishes policies for federal use and development of voluntary consensus standards, and contains guidance for agencies on making their reports to OMB.[20]

Other issues

On top of the application of national standards into technical regulations, several other issues pertaining to the implementation of standards have been identified and discussed in the Medan Workshop.

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[19] For more details on the Public Law 104-113, see:
http://www.gpo.gov/fdsys/pkg/PLAW-104publ113/html/PLAW-104publ113.htm
[20] For more details on the Circular A-119, see: http://www.whitehouse.gov/omb/circulars_a119

Notably, in geographically large economies where there is a strong tradition of decentralized local governance, it is essential to consider the substantial inter-regional differences in the implementation of national standards. In this endeavor, the BSN/Indonesia displays an example. It has signed MoUs with regional / provincial governments to ensure the compliance of standards referred in technical regulations, and to conduct market surveillance on the compliance of products to stipulated standards.

With regard to the costs of adopting and implementing standards, there is a need to ensure that the costs of obtaining standards and relevant certifications are not beyond the means of small and medium-sized enterprises (SMEs). In an effort to reduce the financial burden, SPRING Singapore provides vouchers to SMEs to help them procure consultancy and certification services in the adoption of standards. In addition, it provides funding to assist enterprises in the adoption of new standards for market access and productivity improvement (Box 9).

On balance, the policy objectives of the standards implementation are geared towards building an efficient regulatory arrangement. As the WTO/TBT Agreement sets out, when inappropriately applied, technical regulations can lead to unnecessary restrictions on industry and global trade by unnecessarily increasing the costs. The challenge, then, is to develop a regulatory system which can effectively deal with the increasing demands for regulation in terms of the protection of safety, health, and environment, among others, while ensuring that regulatory interventions are minimized to facilitate an open flow of goods and services across the border. At the international level, there are a growing number of references against which economies may assesse their own regulatory environments. For example, the OECD trade policy paper on "The Use of International Standards in Technical Regulation" provides a valuable toolkit to measure the extent to which technical regulations of individual economies are drawn from, and in harmonization with, existing international standards. (Box 10)

<Box 9> Singapore: Support for Small and Medium-sized Enterprises

SPRING's efforts on assisting the development of SMEs are focused on eight areas: raising productivity, supporting technology innovation, developing human capital, raising service excellence, upgrading business capabilities, nurturing growth-oriented enterprises, nurturing innovative start-ups and driving industry growth. These goals can be achieved by SMEs obtaining standards and relevant certification.

KPIs	2010 Achievements	2011 Achievements
Number of SMEs Upgraded	3,491 (3,318 projects)	3,926 (3,768 projects)
Value-added Committed	$4.8 billion	$4.42 billion
New Jobs Committed	15,895	15,250
Number of SMEs Assisted/Reached	133,842	112,403
Number of SME Committed	9,748 ($2.68 billion)	5,181 ($1.43 billion)

SPRING's SME Development Achievements in 2011

Supporting technology innovation

SPRING has helped SMEs enhance their businesses through technological innovation by offering various programs and incentives. One of the most representative schemes is the **Innovation Voucher Scheme (IVS)** which was launched in March 2009. In 2011, SPRING distributed vouchers to 350 SMEs worth $5,000 each for technology related services and consultancy regarding standards adoption and certification (SPRING Singapore Annual Report 2011-2012, p.6).

The Innovation Voucher Scheme has been replaced by the **Innovation & Capability Voucher (ICV)** since June 2012. The scope has been expanded to support upgrading of SMEs in three new areas which are productivity, human resources and financial management in addition to the existing support on technology innovation activities (ICV FAQ, p.1). Under the ICV scheme, a $5,000 voucher can be disbursed to SMEs and an SME may apply for two vouchers per area for supported services at service providers participating in the ICV scheme. Each project should not last for more than six months.

The criteria for applying for ICV are as follows:
- Physically present and registered in Singapore
- Have at least 30% local shareholding, and
- Have group annual sales of not more than $100 million or group employment size not exceeding 200 employees

Supporting productivity improvement

In 2011, SPRING launched plans to boost productivity for the Retail, Food Services, Food Manufacturing and Furniture industries. Funding of $223 million has been created to support productivity improvement in the four industries over the next five years. Also, support for upgrading productivity in these four industries was provided to 86 companies in 2011. Furthermore, over 4,100 SMEs have been assisted under the Productivity Management Programme (PMP). Assistance was given by providing customized advice and business diagnosis to these SMEs (SPRING Singapore Annual Report 2011-2012, p.6).

For more information, visit:
SPRING official website - Innovation & Capability Voucher (ICV)
http://www.spring.gov.sg/Enterprise/ICV/Pages/innovation-capability-voucher.aspx

<Box 10> OECD Trade Policy Paper on the Use of International Standards in Technical Regulation

This OECD paper focuses on to what extent do economies use relevant international standards as a basis for technical regulation, and develops an analytical template to help governments understand how they actually do, and should use international standards and eventually, measure the impact of such use in trade facilitation. Notably, the paper conducts cases studies of WTO members, amongst which include four APEC member economies, namely Canada, Republic of Korea, Mexico, and the United States.

Analytical Template

The template includes the following elements: 1) what products; 2) what issues or objectives are subject to technical regulation in each sector; 3) which specific regulations are used to achieve those objectives,; 4) whether those regulations reference standards which are accepted as a basis for compliance with regulations, and if so, which standards, and; 5) if regulations do reference standards, what international linkages to those standards, if any, can be identified. Importantly, this template demonstrates the potential for improved transparency and comparison between regulatory practices in different economies.

Data Table Template, excerpted from Fliess, B. et al. (2010), page 16.

To access the full paper, visit OECD Library website:
http://dx.doi.org/10.1787/5kmbjgkz1tzp-en

4.2. Certification systems

Generally speaking, the compliance with technical regulations – mandatory national standards – requires a certain form of confirmation, which may be obtained through testing, certification or inspection by laboratories or certification bodies (WTO, 2013). Depending on the nature of an economy's standardization infrastructure, the framework for the conformity assessment may also differ; a private institute, a public agency, or a combination of the two.

In Korea, where the NSB is a government agency, there is a single, overarching system of certification based upon the "Industrial Standardization Act". It is noteworthy that the accredited certifying body of the KS Certification Scheme is the Korean Standards Association, a private standardization body and implementation arm to the KATS. While the KATS, with an aim to protect consumers, designates certain products and services to be the subject of the KS Certification Scheme, KSA receives applications and issues the certification upon reviewing audit reports submitted by relevant testing laboratories. With regard to the certification of the management system, the Korea Accreditation Board (KAB), which is consigned by the government, serves as accreditation body.

The U.S. conformity assessment system, like the standards system, evolved in a decentralized manner, and approaches vary among sectors. Activities represent a mix of the government-led regulatory programs and the private-driven market programs.[21] Markedly, the system relies on private sector mechanisms to achieve both non-regulatory and regulatory conformance. For example, the National Conformity Assessment Principles (NCAP)[22] for the U.S. is a guiding document that explains key concepts of compliance verification.

Besides, in the discussion on the conformity assessment, it is important to highlight the mutual recognition arrangements (MRAs) as a key policy instrument of trade facilitation and cost reduction in the regional as well as the global economies.

An MRA, in essence, refers to a bilateral or multilateral agreement among economies through which economies agree to "accept the results of one another's conformity assessment procedures, although these procedures might be different" (WTO, 2013). Indeed, demonstrating compliance with different foreign conformity assessment procedures may entail duplicative costs of testing and certification, and are often subject to stricter or more time-consuming requirements for producers and exporters (WTO, 2013). As the WTO/TBT Agreement spells out in provisions on conformity assessment procedures, this also may cause unnecessary obstacles to trade. As a solution to the problem, Article 6.3 of the TBT Agreement strongly encourages members to enter into MRAs. In doing so, it is a prerequisite to promote confidence in the competency of conformity assessment bodies by encouraging information exchange and to harmonize regulatory requirements referenced against relevant international standards.

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[21] Excerpted from the *SI Survey*
[22] For more information, see: www.ansi.org/ncap

Notably at the APEC level, there are a number of regional MRAs, including, for example, APEC MRA for Conformity Assessment of Telecommunications Equipment, and APEC Electrical and Electronic MRA. It is important to note that even though the APEC MRAs are agreed by all members as a suitable trade facilitation instrument, the decisions whether or not to actually participate in, and incorporate the MRAs are still left to the disposal of individual member economies (APEC SCSC, 2005). (Box 11).

In the *SI Survey*, such activities to build confidence in the capacity of a national conformity assessment system are found from the responses of a number of economies; they include MRA arrangements and efforts to comply with internationally recognized guidelines when operating their conformity assessment systems.

The Singapore Accreditation Council (SAC), which is an accreditation body appointed by the SPRING Singapore to accredit conformity assessment bodies, provides an example in this endeavor. Its objective is to develop, maintain, and improve the standards of conformity assessment activities and to facilitate trade by establishing bilateral and multilateral mutual recognition with other economies. Here, relevant international standards are used as guiding principles of its operation; accreditation is voluntary and based on international standards, i.e. ISO/IEC 17025 for laboratories, ISO/IEC 17020 for inspection bodies, ISO/IEC 17021 for management systems certification bodies, and ISO/IEC Guide 65 for product certification bodies. In addition, SAC is a signatory member of various regional and international mutual recognition agreements (MRAs) such as the Asia Pacific Laboratory Accreditation Cooperation (APLAC), Pacific Accreditation Cooperation (PAC), International Laboratory Accreditation Cooperation (ILAC) and International Accreditation Forum (IAF). Through these MRAs, the equivalence of accredited test reports and certifications from overseas partners are recognized. Moreover, any conformity assessment body, whether local or foreign, may operate in Singapore. Accredited bodies may use the SAC mark of accreditation.

<Box 11> **APEC-wide MRAs**

APEC-TEL MRA

The APEC-TEL Mutual Recognition Arrangement (MRA) is a multilateral arrangement between economies in the APEC region. The APEC TEL MRA for Conformity Assessment of Telecommunications Equipment, which came into effect on 1 July 1999, facilitates the recognition of each other's conformity assessment results. In addition, the MRA for Equivalence of Technical Requirements, which was endorsed by the APEC Telecommunications Ministers in 2010, builds upon the MRA for Conformity Assessment by facilitating the recognition of equivalent standards or technical requirements and provides for a further reduction in the costs of conformity assessment. These arrangements are intended to streamline the conformity assessment procedures for a wide range of telecommunications and telecommunications-related equipment, facilitating trade among the signatories to the APEC-TEL MRA. There are 22 partners in the APEC TEL MRA, including all of the 21 member economies of the APEC, as well as the ASEAN.

Excerpted from APEC TEL Website
http://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Working-Groups/Telecommunications-and-Information/APEC_TEL-MRA.aspx

APEC-SCSC Electrical and Electronic Equipment Mutual Recognition Arrangement (EEMRA)

The Electrical and Electronic Equipment Mutual Recognition Arrangement (EE MRA) is intended to apply to all instances, both pre- and post-market, where test reports or certification are used as the basis for regulatory compliance with respect to electrical and electronic equipment. The EEMRA has three parts reflecting the different levels of participation:

Part I commits that information about a participating APEC Member Economy's mandatory requirements on regulated electrical and electronic products is provided in a standardized format to assist those in other APEC Member Economies who may wish to export electrical and electronic products to that economy. At present, 17 Member Economies are participants in Part I of the MRA.

Part II of the MRA commits participating APEC Member Economies to mutually accept test reports produced by testing facilities designated by participating economies in accordance with the designation requirements of the EE MRA. The designation requirements are in accordance with the relevant ISO/IEC Standards and do not require re-testing.

Part III commits a participating importing APEC economy to accept product certification (including batch testing) produced by certification bodies designated by participating exporting economies in accordance with the designation requirements of the EE MRA. The designation requirements are in accordance with the relevant ISO/IEC Guide. Certification bodies may issue product certificates (Certificate of Conformity), which are acceptable in participating importing economies, thus negating the need to re-certify the product.

Excerpted from APEC EEMRA Website
http://www.apec.org/Groups/Committee-on-Trade-and-Investment/Sub-Committee-on-Standards-and-Conformance/apec_eemra.aspx

4.3. Dissemination

By far, the dissemination of standards is one of the key responsibilities of an NSB. The result of the *SI Survey* reveals that the participating economies carry out this role in several different aspects, including, for example, the sales of national, regional or international standards, provision of information services, and operation of promotional and marketing activities. Even though the specifics differ from economy to economy, the major channel of dissemination has gradually shifted towards online initiatives while maintaining the traditional offline avenues still in play. This reflects the efforts to increase the accessibility of standards.

NSBs should take efforts to minimize any obstacles to access the standards, for example, the price of standards document. As mentioned in detail in Chapter 3, the sales of standards may take up a significant portion of an NSB's income stream. From the aspect of the standards dissemination, the key concern in the pricing decision regards to striking the right balance between the two values critical to the sustainability of an NSB; the revenue generation and open, public access to knowledge.[23]

In addition, most of the responding economies operate websites or web portals through which key information services and online sales of standards documents take place.

In Korea, there are two information systems that are responsible for the dissemination of national standards: Korean Standards Information Center (KSIC)[24] under the KATS representing the government-side effort, and the Korean Standards Service Network (KSSN)[25] under the KSA driven by the private sector. The KSIC provides an online access to national standards as well as operates an offline reference library for public access. The KSSN, through the web store, electronically sells national standards and provides membership-based information services, while at the same time it publishes hardcopy reports and publications regarding standards.

In addition to the information systems, KATS operates a single window TBT inquiry point to improve the transparency of Korean conformity assessment procedures and technical regulations, in an effort to build confidence and improve transparency of the system through online dissemination of information (Box 12).

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[23] Further discussions on this issue are provided in Chapter 3.
[24] For more information, see: www.standard.go.kr
[25] For more information, see: www.kssn.net

In the United States, ANSI administers a website called the National Resource for Global Standards (NSSN).[26] Basically, the website is a one-stop resource portal, presenting an online shop, a catalogue of library, along with a directory of standards related organizations. Using the NSSN search engine, users can find standards-related information from a wide range of developers including the information about organizations accredited by ANSI, other U.S. private sector standards bodies, government agencies, and international organizations. It contains more than 300,000 records and provides easy links to obtain standards and related technical documents. In addition, the database includes technical contact information for standards developing organizations. Once users find the standards they are looking for, the documents are available for purchase from a variety of outlets according to the licensing rules and arrangements of the standards developing organizations. Each SDO also maintains its own website and database which serves as a rich resource of information about their respective standards.

The table below outlines the website information of the NSBs from the participating economies.

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[26] www.nssn.org

[Table 2] Websites of NSBs in the participating APEC economies

Economies	Websites
1. Australia	Standards Australia http://www.standards.org.au
2. Canada	Standards Council of Canada http://www.scc.ca
3. Hong Kong, China	Not applicable
4. Indonesia	National Standardization Agency of Indonesia (BSN) http://www.bsn.go.id
5. Japan	Japanese Industrial Standards Committee (JIS) https://www.jisc.go.jp/eng/
6. Republic of Korea	Korean Agency for Technology and Standards (KATS) www.kats.go.kr
7. Malaysia	Department of Standards Malaysia http://www.standardsmalaysia.gov.my/
8. Mexico	National Bureau of Standards of the Ministry of Economy http://www.economia.gob.mx/standards_
9. New Zealand	Standards Council of New Zealand http://www.standards.co.nz/
10. Peru	National Institute for the Defense of Competition and Protection of Intellectual Property (INDECOPI) http://www.indecopi.gob.pe/0/home.aspx?PFL=1
11. The Philippines	Bureau of Product Standards (BPS) http://www.bps.dti.gov.ph/activities.html
12. Singapore	SPRING Singapore http://www.spring.gov.sg
13. Thailand	Thai Industrial Standards Institute (TISI) http://www.tisi.go.th
14. The United States	American National Standards Institute (ANSI) http://www.ansi.org
15. Viet Nam	Directorate for Standards, Metrology and Quality of Vietnam (STAMEQ) http://en.tcvn.vn/

4.4. Recommendations

This chapter has discussed various issues related to the implementation and dissemination of standards.

With international trade growing apace, the mechanism and effectiveness of standards implementation has gained renewed attention. On one hand, by translating adequate standards into technical regulations, an economy may control the quality of imported goods, in order to protect the environment and safeguard the health and safety of its citizens. On the other hand, as the WTO TBT Agreement stresses, inappropriate implementations of mandatory standards may cause unnecessary obstacles to international trade.

APEC economies, both individually and as a regional group, need to make their best efforts to meet these dual policy objectives concerning the standards implementation; for example, by adhering to the disciplines and guidelines stipulated by international standardization or trade organizations, and establishing co-operation mechanisms such as MRAs under the principle of "*tested once, accepted everywhere*" (Stephenson, 1997, page 71). To this end, as this report attempts to demonstrate, it is a significant task to develop and utilize a shared guideline for establishing standardization infrastructure among APEC member economies.

In addition to the inter-economy level of collaboration, NSBs should consider diversifying the information services provided through offline and, with increasing importance, online channels. For example, KATS/Korea provides early alerts to the industry on standards that are currently being developed by the standards bodies. Such information, available through its information system, is encouraging not only because it addresses the unmet information needs of its stakeholders, but also because it provides an avenue of participation for the interested groups and individuals.

Insomuch as the TBT obligations address the transparency and competency of standards implementation, the goal of widespread implementation of standards concerns the strengths and competency of the stakeholders of the standards infrastructure, as they need to openly and actively participate in the dissemination process. As will be discussed further in "Chapter 5 Human Resource Development for Standardization", garnering a robust support base from the stakeholders is critical to the adequate adoption of standards.

Chapter 5. Professional (HR) Development

Human resources (HR) are considered one of the most vital factors of economic and social development (de Silva, 1997). Under the volatile global economic climate, acquiring and retaining quality talents directly affects the ability of an organization, or even an economy, to successfully adapt to the changing environment and to enhance its competitiveness and sustainability.

HRD (Human Resources Development) in standardization, likewise, is an important cornerstone of the development of standards infrastructure. Notably, a growing body of research on HRD in standardization has been emerging from standards research communities. These studies address the strategic importance of strengthening HRD for standards both in numbers and in quality, and discuss different approaches to identify target groups and to design education and training programmes attuned to their specific needs (Kurokawa, 2005; de Vries & Egyedi, 2007; Choi & de Vries, 2011; de Vries, 2011).

On one hand, a stream of research focuses on the development of skills and knowledge of **standards professionals** in order to facilitate competency and efficiency of standardization in companies, industries and societies. Under this perspective, HRD[27] in standardization is a strategic tool for companies and economies to stay competitive in the international market (Kurokawa, 2005; Choi & de Vries, 2011). The ultimate aim of HRD in standardization is to create a rich pool of standards professionals equipped with a deep insight in their specific industries, a competency in international standardization, as well as an ability to keep abreast with the rapidly changing technology, market, and policy environments (Choi & de Vries, 2011).

On the other hand, it is noteworthy that the concept of HRD in standardization research has expanded over the years from solely emphasizing individual professional's capacity to building the capacity at organizational and national levels. This perspective, which is equally emphasized for the purpose of this chapter, broadens the scope of standards-related education and trainings and links them to the national-level strategies that are geared **towards raising awareness of the general public** as consumers of standards (Swann, 2000). In this sense, HRD in standardization means not only developing standards professionals and enhancing their expertise in standardization, but also raising awareness of the public as a foundation of national standards infrastructure.

At the practical level, these research streams touch upon the problem of **recruiting young professionals** in the face of a growing generational gap. Many economies are encountering a lack of interest from young generations in standardization activities, and consequently, technical knowledge and experiences of the current experts are not adequately passed down

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[27] The term is used interchangeably with "professional development" in this chapter.

to the next generation. To a certain degree, this may reflect general trends in most economies in which traditional science and engineering careers are no longer attractive in comparison to professions in business, banking, information technology and legal arenas. Therefore, on top of the promotional efforts to engage existing professionals in the field, initiatives should also be considered with a priority to encourage the influx of next generations.

With this background, this chapter delves into the HR development strategies for standardization in the APEC member economies, as to how current and future standards professionals are recruited, retained and engaged. In particular, the following three questions are asked:

1. What kind of training and education programs do you have for standards professionals? How many are they and how many trainees are per year?

2. Do you have any qualification scheme for standards professionals?

3. What kind of programs do you have for encouraging and promoting standards professionals' engagement with standardization activities? (i.e. networking programs, remuneration and incentives for career development)

This chapter is organized according to the above three questions. For each question, an analysis of the *SI Survey* responses is presented first, followed by discussions on key issues and notable cases.

5.1. Training and education programs for standards professionals

The result of the *SI Survey* displays that current training and education programs in the APEC economies can be categorized into two groups:

- Education programs conducted in part of standards curriculums for primary, secondary, and tertiary schools, and

- Other trainings and programs for current professionals conducted outside the boundary of formal education.

Based on the responses from the *SI Survey*, Table 1 displays the education and training programs currently conducted or being developed in the 15 responding economies (Table 3).

Economies	Formal education for students	Professional education for current professionals
Australia	N/A	None - Training for Standards Australia committee members are currently in development.
Canada	N/A	Yes - Training modules for international technical committee members (mainly ISO or IEC)
Hong Kong, China	Yes - Some universities provide courses that include ISO and IEC standards.	None
Indonesia	- The development of undergraduate program is underway since 2005 in collaboration of 31 universities. - A master program is being developed since 2012.	None
Japan	Yes - Student programs	Yes - Trainings for the chairpersons, secretaries and conveners who have an official role in international standardization, in order for them to learn the rules for developing standards. - Trainings for beginners and intermediate courses exist.
Republic of Korea	Yes - Programs for college students to foster future standards professionals, including the "Specialized Training Courses on Technical Standards," conducted in 67 classes with 2,756 students in 2011 - Programs for primary and secondary school students including "Fun Standards" and "Standards Olympiad"	Yes - Training courses for fostering international standards professionals - Training courses for fostering working-level human resources to boost standardization management of businesses
Malaysia	N/A	Yes - Trainings for Standards Development Committees (twice a year for approx. 30 people) - Trainings for Standards Development Agency (yearly for approx. 30 people)

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[28] The table is filled based on the *SI Survey* responses. As such, it may not be a comprehensive list and miss some programs.

Mexico	N/A	N/A
New Zealand	None	None
Peru	N/A	Yes - Ad-hoc trainings for INDECOPI secretariat and technical committee members are conducted in part of international/ regional cooperation initiative - Training modules of the chairpersons, secretaries of technical committees (mainly ISO mirror committees) are currently in development
The Philippines	None	None
Singapore	N/A	Yes - Workshop on ISO metrology, once per year for approx. 20 people - Training for SC/TC Chairs and WG conveners, once per year for 20 people - Training for Secretaries, once per year for approx. 5 people
Thailand	Yes - An initiative to integrate standardization in education is underway for secondary school teachers and students	Yes - Capacity building trainings for industries are conducted throughout the year on various topics - In 2012 a total of 26 trainings conducted for 1,043 people
The United States	Yes - Online portal provides an e-learning course for university-level curriculum. - Student paper competitions are conducted annually for associates [29], undergraduate, and graduate level students	Yes - ANSI Committee on Education (CoE) provides professional development programs via e-learning portal (www.standardslearn.org) for broad audiences including professionals
Viet Nam	N/A	N/A

Standards education in formal school systems

The formal school system provides an ideal environment within which to impart the common knowledge and value of standards as general education.

In the *SI Survey*, only a small number of economies respond that they currently have such formal education programs in place (Table 3). The cases of Japan and Korea illustrate good

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[29] An associate degree in the U.S. education system generally refers to an academic degree awarded by community colleges, junior colleges, four-year universities, business colleges and some bachelor's degree-granting colleges/universities upon completion of a course of study usually lasting two years.

examples of school-based standards education programs that are built upon a clear set of targeting strategies, ranging from educational activities for primary and secondary schools to specialized lecture series for college and university students. It is noteworthy that Indonesia and Thailand are currently on track to develop standards education curricula within the formal school systems, which are believed to provide valuable examples for other developing economies to emulate such an initiative. In addition, the case of ANSI in the United States sheds light on a different approach to promote standards education, capitalizing on the wide variety of its membership and the extensive online outreach.

In Korea, standards education programs run by the KSA are designed to achieve the dual goals of fostering future standards professionals and providing a set of life-long standards education curricula tailored to different needs and knowledge levels. As shown in Figure 1, KSA has developed a standards education roadmap aimed to build a lifelong learning system in standards. The roadmap's framework consists of two major channels of delivery, formal and post-formal, displayed in the x-axis, and five stages of standards education in the y-axis.
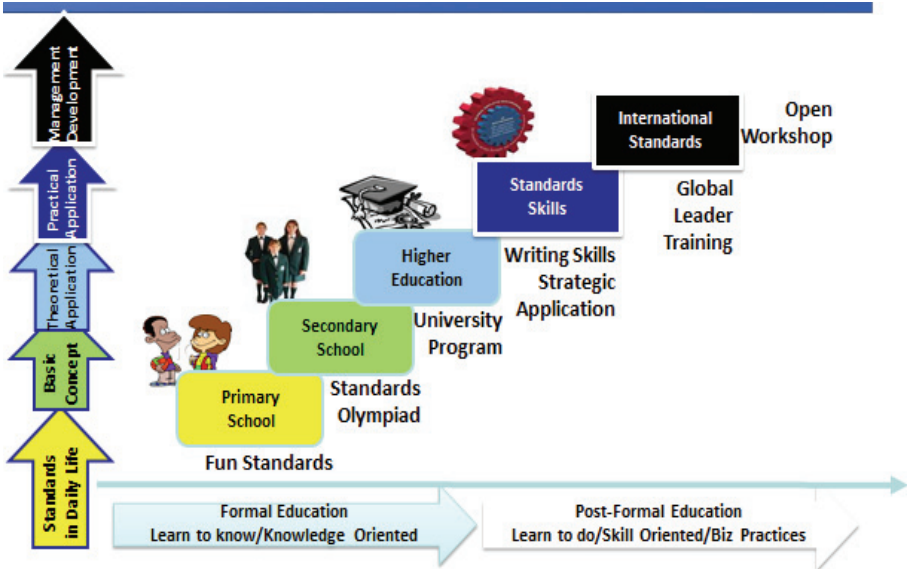
[Figure 1] Roadmap of life-long learning system in standards, KSA/Korea

In the formal education including primary, secondary, and higher education, the education curricula are centered on imparting general knowledge of standards to students through activities, school-wide competitions, and Olympiads, so that students can build basic concepts on the development, use, and impact of standards in everyday lives (Box 13). The university-level programs receive a special attention in the roadmap, as it nurtures next generation professionals among university students who would eventually take further trainings through the post-formal education programs that are geared towards more practical business and management applications of standards. For example, according to the survey

response, the "*Specialized Training Courses on Technical Standards*" lecture series for university students were delivered in 67 classes for almost 3,000 students in 2011, with three volumes of standards education materials developed for the course.

<Box 13> **Korea: Lifelong Standardization Education Program**

The Lifelong Standardization Education Program is a public-led education program carried out by Korea Standards Association (KSA), an implementation arm of the Korean NSB KATS. The program provides a systematic roadmap of standards education from primary schools to higher education institutes, which is closely embedded into the formal education curricula in cooperation with the education community.

"Meet Standards" for Primary Schools
The "Meet Standards" program for primary schools aims to show that standards are part of everyday life and to provide standards-related experiences to teachers and students. From 2011, pilot programs took place with 7,443 students in 9 school in 2011, 6,549 students in 9 schools in 2012, and 3,939 students in 10 schools in 2013. The program has developed curriculum covering what and how to teach for standards education, for instance, by creating teaching tools such as guidelines for teachers, animation, PPT, etc., designing learning activities such as the "STANDARDS ROOMS" in school with the standardized items (e.g. pencil, mobile, ruler, etc.), and organizing standards-related events with parents (e.g. standards festivals, essay contests, etc.).
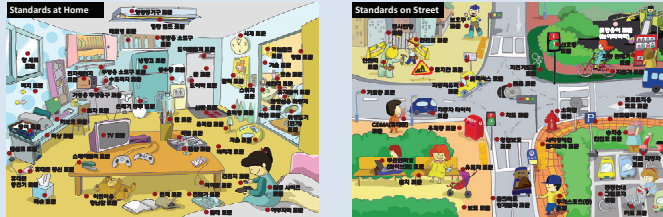
Standards Rooms Teaching Materials

"Explore Standards" for Secondary Schools
The "Explore Standards" program for secondary schools aims to bring standards to the real life and allow students to recognize outcomes of using standards in the society. The program is divided into two components. First, students learn standards from textbooks recognized by the Ministry of Education. For example, "Understanding Standardization" is set as a key performance indicator for the part of manufacturing technology of the subject in the middle school and "Recognizing the Importance of Standardization for Product Developments" is set as a key performance indicator for the part of engineering technology of the subject in the high school. Second, students experience standards from specially developed activities such as Youth Standards Olympiad (YSO).
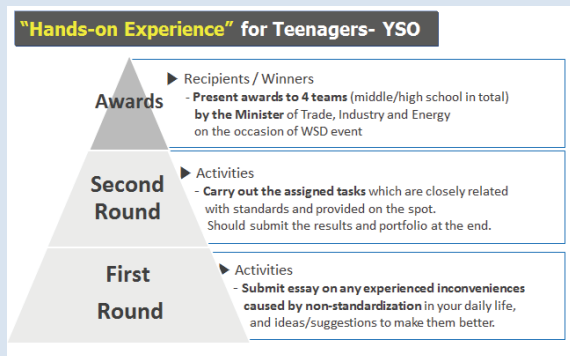
Youth Standards Olympiad (YSO) Activity Structure

It is also notable that a number **of emerging economies** in the APEC region are currently developing standards education programs within their formal school systems.

Among others, the BSN/Indonesia is vigilantly increasing its efforts to establish undergraduate and graduate-level education programs on standards. Markedly, BSN has signed memorandums of understanding (MoU) with 31 universities in Indonesia since 2005 in order to develop and establish courses on standardization for undergraduate students. These MoUs also cover promoting involvement of experts from universities in standards development. For graduate level programs, BSN has signed an MoU with the Directorate General for Higher Education, Ministry of Education and Culture of Indonesia in 2012 to develop and establish a master program on standardization, quality management and metrology. In addition, various supportive initiatives have been developed to help standards education integrated into the formal school system, such as the Standardization Education Forum, the Forum of Youth Standardization and the Institute for Standardization at Trisakti University.

Another such example is Thailand. TISI has embarked on a project to integrate standards education into the formal curriculum at secondary schools since 2010. It is notable that the education program covers trainings for both teachers and students, recognizing the fact that teachers' knowledge and capacity is essential to bring about satisfactory educational outcome. A total of 92 trainings were conducted from 2010 to 2012, with more than 3700 students and teachers taking part in the programs.

Besides, in the Unites States, ANSI provides a wide variety of training and education programs tapping into its rich pool of industry members combined with the extensive online outreach. The box below provides educational outreach activities *of ANSI's Committee on Education (CoE)* as well as those of *American Society of Testing and Materials (ASTM) International*[30], an SDO member of ANSI, as good examples of collaboration among SDOs, industry, and academia to extend the educational outreach for standards promotion (Box 14).

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[30] For more information, see: http://www.astm.org/

<Box 14> **The United States: ANSI's Standards Education Portal**

ANSI's CoE was established in May 2003 and its current roster includes: 1) over 60 members from companies such as Boeing, Intel, Microsoft, Oracle, Qualcomm, and Siemens, 2) SDOs such as ACTE, ASME, ASTM, IEEE, and UL, and, 3) Higher Education Organizations such as Michigan State, Purdue University, San Jose State, and University of Pittsburg, among others.

www.Standardslearn.org

ANSI has developed an online educational portal (www.Standardslearn.org) which provides free and publicly available educational resources for broad audiences. Since the web portal was launched in 2007, it has logged more than 200,000 visits. Components include free courses such as *Through History with Standards* as well as the *US Standards System – Today and Tomorrow*, an *Acronym Directory* of commonly used acronyms in the standards and conformity assessment community, and a Standards Education Database with links to web-based education and distance learning resources related to standards and the organizations that develop them. In addition, the *Standardslearn.org* web portal includes links to case studies, crossing a variety of disciplines, where standardization – either the concept or actual practice – helped in the resolution of real world problems. Currently fifteen case studies have been published.

There are also new e-learning courses available free of charge. The first, *An Introduction to Standards: Why, where and how are they developed* was launched in September 2010. ANSI received several requests from universities to use the course as part of their curricula. The second entitled, the *U.S. Delegates to International Activities: Roles and Responsibilities* was launched in May 2012 and has been very well received.

Some CoE Initiatives include the use of subject matter experts as a resource to provide guest lecturers for university courses on standards. In addition, in 2013, the 2nd Student Paper Competition of the CoE was held, under the theme of *"Standards and Emerging Technology Decisions – What Role Do Standards Play in Disaster Recovery and Business Continuity?"*

ASTM International

In addition to activities directly conducted by ANSI CoE, many of ANSI's members are actively engaged in training and education programs for standards professionals. For instance, ASTM International has developed resources for professors to facilitate integration of standards into their academic programs. One such resource is the "Professor's Tool Kit" DVD which includes several new tools in a variety of formats, including scripted PowerPoint presentations (in Spanish, Mandarin and Portuguese), and a new video on the value and importance of standards (www.astm.org/campus). Moreover, ASTM International also launched a leadership program in 2013 to better promote the professional development opportunities resulting from involvement in standards development activities. This initiative offers educational resources that support many skills acquired by engaging in ASTM technical committee activities. The "Leadership Connection" campaign enhances and extends the longstanding offerings ASTM has provided to university professors to support standards education (www.astm.org/LEADERSHIP).

Standards education/training for working professionals

With regard to education for working professionals, most economies respond that they currently run training programs for technical committee members, committee chairs or conveners, or secretaries who support standards development activities (Table 3).

In case of Canada and Singapore, such trainings mainly aim at strengthening the capacities required for participating in **international standardization activities**, including, but not limited to, those for ISO/IEC technical committees. By the same token, in Korea, training programs for current professionals primarily concern with fostering professionals specialized in international standards development such as the global leader training. The global leader training, started since 2008, is offered in three levels. The beginners' course is provided in 6 modules for two days, covering the strategic importance of international standardization activities for business management, and basics of international standards organizations and expert committee system. The intermediate course is also carried out in two-days, covering ISO/IEC directives and exercises on standards documents drafting. The leaders' course is a one-day program – covering mid- and long-term strategies for international standardization activities, as well as expert activities such as ISO committee chairs and conveners.

On top of that, trainings for professionals are designed to **nurture industry-specific experts** as well as specialists in management and **strategic planning** in order to strengthen the standards management and application capacities of businesses, for example, through open workshops and e-learning programs. Furthermore, these post-formal education programs can be considered as a strategic tool to build a linkage between the national R&D strategy and the standards development strategy at the practical level, for example, by providing standards-patent education for researchers and personnel responsible for planning of R&D. KSA/Korea offers a series of capacity building programs for standards professionals. The basic program addresses standards policies and technical regulations, while intermediate course covers specific standards such as Korean Industrial Standards (KS), and company/community standards. The advanced course addresses the linkages among standardization strategies, R&D, and intellectual property for a business.

On a different note, in emerging economies where technical knowledge and infrastructure on standards are somewhat limited to develop training programs on their own, bilateral or multilateral cooperation programs on standards education may provide a solution.

For example, INDECOPI/Peru tapped into a variety of international cooperation initiatives to train the organization's secretaries and chairs of its technical committees. In collaboration with the Standards Council of Canada since 2012, INDECOPI staff members have received trainings on strategic tools for standardization and international standardization through the experiences of Canada. At the regional level, INDECOPI is actively engaged in the development of standards professional program at the Pan-American Standards Commission

(COPANT),[31] which aims at providing a set of standardized professional development training modules applicable to COPANT member economies.

As shown above, HRD in standardization should target different groups of people, including professionals directly involved in standards development in their specific field of work, the users of standards in everyday life indicating the general public, as well as the government officials and scholars who deal with the development and management of standards (Kurokawa, 2005). Consequently, training and education programs should consider their varying needs and levels of existing knowledge on standards, and utilize different delivery methods. Examples of Korea and United States display the advantages of mapping out targeting strategies for standards education and tapping into online and offline resources to extend the educational outreach. Last but not least, regional and international cooperation on standards education can become a powerful tool of disseminating technological knowledge on standards across the APEC, as advanced economies can share their experience with emerging economies to strengthen the latters' standards infrastructure.

5.2. Skillsets and qualification schemes

Qualification schemes for standards professionals serve as an affirmation that qualified professionals meet the criteria of competency and excellence in terms of their knowledge and skills on standards as defined by the accrediting organization. By establishing a qualification scheme for its standards professionals, an economy may assure the quality of human resources in standardization activities and thereby strengthen the overall robustness of its standards infrastructure. However, the establishment of such a system is not easy because it requires a thorough specification of methodologies, processes, skills and tasks relating to standardization in a given economy.

In the *SI Survey,* only one out of 15 economies, Korea indicated that it currently has a qualification scheme for standards professionals. Similarly, Japan noted that it is in the preparation stage to develop such a scheme by recently releasing standards-related skillsets as a reference for interested companies and organizations.

KSA, under the guidance of KATS/Korea, offers a certification system among the 15 participating economies, which validates the qualification of standards experts by evaluating their standardization abilities. The Certified Standards Professional (CSP) program aims to strengthen the capacity of standards experts in the industry, academia and research sectors to proactively address standards-related problems and issues arising from their respective fields. As shown in Figure 2, the CSP program provides certifications in two categories – Class 2 for the basic level and Class 1 for the advanced level – which can be obtained by individuals

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[31] For more information, see: http://www.copant.org/en/web/guest/home

upon passing certificate examinations.[32] For each certification level, a set of evaluation criteria is established encompassing general knowledge of standards as well as technical expertise in the specific sectors of the business (Figure 2). To help experts and interested young professionals prepare for the certification examinations, KSA offers customized training courses. The training course for Class 2 consists of forty-hours of classroom training, which covers six introductory modules: 1) the introduction to standardization, 2) planning and management of standards and standardization, 3) international standardization, 4) standards and companies, 5) metrology and product standards, and 6) certification, conformity assessment and accreditation. The training course for Class 1 is composed of eighty-hours of classroom training and provided in three tracks according to the applicants' occupational groups, like 1) standards planning, 2) standards development, and 3) standards application.

Certificate Level	Evaluation Criteria		Certificate Level	Evaluation Criteria		
CSP Class 2	Basic occupational knowledge regarding the planning, development, and application of standards	→	CSP Class 1	In-depth occupational knowledge regarding the planning, development and application of standards	+	Evaluation Criteria for CSP Class 2
	General knowledge of standards, mainly drawn from textbooks for college-level introductory courses on standards			Advanced knowledge of unit-specific standards, including intra-company, organizations, nations, and international standards		
				Advanced knowledge of sector-specific standards		

[Figure 2] Qualification scheme for Certified Standards Professional (CSP), KSA/Korea
Source: www.standardportal.or.kr

On another note, the *standards skill indicator* developed by JISC, Japan exhibits efforts to develop a qualification scheme for standards professionals.[33] When compared to its Korean counterpart which is a fully-developed proficiency test for standards professionals accredited by the Korean NSB, the *standards skill indicator* has slightly different characteristics as a reference material on standards HRD, against which companies can spell out their standards-

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[32] In July 2013, training courses for the Certified Standards Professionals Classes 1 and 2 were conducted for the first time, followed by the qualification examinations in September 2013.

[33] For more information, see: http://www.jisc.go.jp/policy/skill/docs/english.pdf

related processes and tasks, and assess the strengths and weaknesses of their HR in standardization. As JISC states, the Indicator is "a tool to visualize standards-related tasks in private for-profit companies, and for each such task to identify indicators such as performance and capability indicators in order to evaluate the ability of human resources on standardization-related activities, and to help planning HR development for standardization" (JISC, 2013). As shown in Figure 3, the Indicator identifies a total of 36 tasks for standardization, which are sub-grouped in four according to the task-phases: 1) strategy, 2) development, 3) implementation, and 4) promotion. Tasks in each phase are further divided depending on the type of standards being addressed, such as de-jure standards, forum/consortium standards, de-factor/company/ product standards, house-rules or all-types.

Altogether, it is important to note that such a list of qualification criteria can never be complete and should always reflect the specific context of the given organization and the economy concerned. However, generally speaking, a qualification scheme for standards professionals can be a useful tool not only to evaluate the existing skills and knowledge of standards-related human resources, but also to define the tasks, processes and methodologies related to standardization activities, inform and share those tasks within the organization, set a target of education, and develop education programs tailored to the identified needs so as to strengthen the overall standards capacity of the organization. In addition to the institutional perspective, a qualification scheme serves as a strong motivator for individuals to further develop their career path in standards.

			De jure standards	Forum/Consortium standards	De facto/Company-Product standards	House rules	All types		
							34) Considering compliance	35) Considering human resource development	36) Considering intellectual properties
Task Phase	Strategy	Strategy planning	1) Strategy planning for standardization						
		Tactios planning	2) Information collecting/analyzing/evaluating and tactics planning						
			3) Supervising(Strategy)						
			4) Liaison establishing(Strategy)			N/A			
		Founding organization	5) Founding organization(De jure standards)	6) Founding organization (Forum/Consortium standards)	7) Founding organization (De facto/Company-product standards)	N/A			
		Managing organization	8) Managing organization (Strategy, De jure standards)	9) Managing Organization(Strategy, Forum/Consortium standards)	10) Managing organization (Strategy, De facto/Company-product standards)	N/A			
	Development	Developing technology	11) Developing associated technology						
		Developing standards	12) Proposing new work items(De jure standards)	13) Proposing new work items (Forum/Consortium standards)	14) Proposing new work items (De facto/Company-product standards)				
			15) Drafting standards(De jure standards)	16) Drafting standards (Forum/Consortium standards)	N/A				
			17) Negotiating (De jure standards)	18) Negotiating (Forum/Consortium standards)	19) Marketing(De facto/Company-product standards)	N/A			
		Managing organization	20) Managing Organization (Development, De jure standards)	21) Managing Organization (Development, Forum/Consortium standards)	21) Managing Organization (Development, De facto/Company-product standards)	N/A			
	Implementing	Applying standards	23) Applying standards						
		Acquiring certification	24) Conformance testing			N/A			
			25) Acquiring certification	26) Acquiring forum certification	27) Acquiring Private certification	N/A			
	Promotion	Promotion planning	28) Information collecting/analyzing/evaluating and promotion planning			N/A			N/A
			29) Supervising(Promotion)			N/A			
			30) Liaison establishing(Promotion)			N/A			
		Advertising	31) Advertising (De jure standards)	32) Advertising (Forum/Consortium standards)	33) Advertising (De facto/Company-product standards)	N/A			

[Figure 3] Tasks of standardization according to the standards skills indicator, JISC/Japan

Source: JISC, 2013

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5.3. Programs for engaging professionals and academics

The *SI survey* uncovers how some of the APEC member economies provide supportive programs to boost professionals' engagement in standardization activities. One of the most common programs identified from the survey result is an **annual award**, which recognizes

the contribution the awardee has made to standards development. A straightforward **financial support** program for standards professional is also found in a number of economies including Indonesia, Korea, Mexico, Peru, and the United States, through which young professionals or mid-level experts may receive grants for attending national or international standardization meetings and/or education.

Another frequently implemented support program is **networking events** such conferences and fora to promote interaction and networking among standards professionals and key organizations. The Society for Standards and Standardization of Korea, and the Indonesian Standards Society are examples of multi-stakeholder forums for standards experts. In some cases, these networking communities broaden their scope and formalize the procedure to evolve into conferences and forums, as in the case of the annual Global Forum for Standards Policy in Korea. Since the establishment of the Forum in 2012, more than 100 experts have gathered to discuss a variety of issues including technology and standards policy, international standardization strategy, and technical barriers to trade (TBT) measures.

In addition, the provision of performance incentives for standardization activities may further facilitate the engagement of standards professionals. As in the case of Korea, it is considered effective to integrate the performance indicators of standardization activities into the performance evaluation for individual professionals.

From the perspective of **recruiting new talents in the standardization field**, the ANSI/ United States provides an interesting case. The ANSI federation conducts many activities designed to encourage involvement of the next generation in standardization activities. There is an acknowledged need in the U.S. and beyond to create mechanisms that will bring a steady stream of new participants into the standards and conformity assessment arena, even though such mechanisms may vary from one context to another. To illustrate, the *ANSI COE – USNC/IEC Joint Task Force on Emerging Professionals* program was designed to address the particular challenges of emerging professionals in standards, in recognition that current practitioners in the field are aging and nearing retirement, and that concrete steps need to be taken to nurture and mentor young generations so as to ensure a sustained cycle of knowledge transfer.

Similarly, the Young Leaders Program of Standards Australia (Box 15) and the program for human resource development and technical standards of KSA (Box 16) provide examples of next generation initiatives.

<Box 15> **Australia: Young Leaders Program**

The Young Leaders Program was launched by Standards Australia in 2012 and continued throughout 2013. In 2012, the program was initiated with the invitation of 10 young professionals to participate in it for 12 months. The Young Leaders Program was designed for the purpose of bringing the future expert engineers, technicians and managers together. Also, it was aimed at providing an opportunity for young professionals, in their mid 20's to mid 30's, to engage in national and international standardization activities and conformity assessment frameworks that are crucial for the Australian industry. Through the program, it is anticipated that young professionals will be able to develop expertise and skills that are essential for participating in technical committees.

Description of the program

The Young Leaders Program provides formal training in the standards development process. The appointed Young Leaders are trained in drafting standards, learning conformity assessment and writing for a non-technical audience. They are also trained in developing negotiation and leadership skills that are important to be an effective committee member. As mentees, the appointed 10 Young Leaders are paired with 10 mentors who have abundant experience in their career for standards development.

The role of the mentors is to assist the Young Leaders in their career and leadership development in standardization and to provide mentees with the opportunity to attend actual committee meetings in active standards development projects as observers. According to the plan for 2013-2014 Young Leaders Program, mentors are expected to have the mentees attend two technical committee meetings. Although mentors will not always be from the same technical field as the mentee, the pairing system will be arranged so that mentors and mentees have similar interest as well as knowledge in a similar field. The interesting part of the program is that mentors and mentees have to attend workshops that last for a total of three days. These sessions include training in drafting standards and building negotiation skills.

Excerpted from:
Standards Australia official website: Our Organization – Young Leaders Program
http://www.standards.org.au/OurOrganisation/Pages/Young-Leaders.aspx
http://www.standards.org.au/Documents/120904%20Young%20Leaders%20Program.pdf
http://www.standards.org.au/Documents/Young%20Leaders%20and%20Mentors-
Call%20for%20Applications,%202013-2014%20Program.pdf

<Box 16> Korea: Program for Human Resources Development and Technical Standards

The program, carried out by KSA, has dual goals of nurturing the next generation experts of technical standards and providing job/internship opportunities for recent graduates to fill in the shortage of manpower in the industry. The program, open for university students and recent graduates, provides four-weeks of classroom trainings and an opportunity to participate in the field training as an internship for four months.

Process

The program, piloted in 2013 for the first time, was carried out in a 8-month project cycle consisting of: selection of candidates, classroom trainings of candidates, matching between candidates and companies, and field training (internship). The program is offered in three tracks: 1) Strategic planning and research for standardization, 2) Testing & analysis / Corporate standards, and 3) KS accreditation and quality assurance.

Curriculum

As shown in the figure below, the curriculum combines six core abilities expected from the next generation standards experts. Upon completion of the training, candidates are expected to achieve the following goals.

- Learn a strategic approach to develop their career path
- Strengthen their understanding of standards as young leaders of technical standards
- Understand the importance of R&D and standardization and develop a ground for practice
- Obtain hands-on experiences and skills that are readily applicable to the companies
- Build capacity as a standards/ quality assurance expert
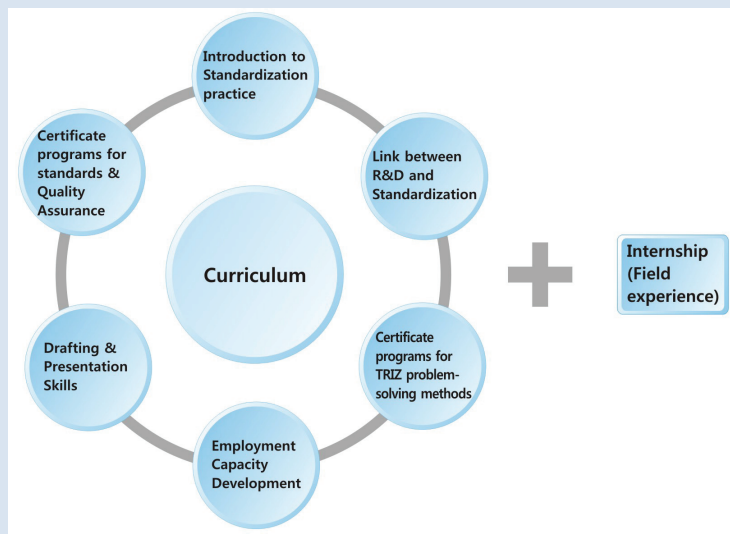
Excerpted from the program homepage at:
http://stdleaders.or.kr/ (Korean)

As a whole, successful HR management requires efforts not only to recruit talents, but also to engage and retain them. In this regard, it is important to develop and offer programs that are designed to encourage and promote professionals' continuous engagement in standardization activities, including networking events and financial support schemes for international standardization activities. Additionally, a mechanism to ensure a continuous inflow of new talents should be put in place in order to prevent the generational gap of standards experts from widening.

5.4. Recommendations

To sum up, this section has explored the APEC economies' HRD in standardization, with particular interests in their formal and outside-school education and trainings programs, qualification schemes, and programs for engaging professionals.

In order to invigorate the community of standards professionals, there are a number of ready-made suggestions including:

- *Raise awareness and promote the profession of standardization by having dedicated promotion materials and a 'Career' tab on the NSB website.*

- *Develop HR capacity to deal with international standardization activities. Take the opportunity to send staff to international training activities such as ISO and IEC professional development courses.*

- *Ensure that there are formal mechanisms and expectations for knowledge transfer, i.e. through training of trainers*

- *Utilize the existing standards education materials available online. In developing economies, tap into opportunities for regional/international cooperation.*

The findings in this chapter, however, indicate that standards education at different levels should aim at the dual goals of building a national knowledge base for standardization and increasing standardizations human resources. In this regard, further efforts and higher levels of investments are required to strengthen the overall HRD in standards infrastructure.

Standards education for general public as consumers of standards is important. Raising the public awareness on the value of standards is critical to obtain support from the public and ultimately from the parliaments and any organizations responsible for resource allocation, in order to increase the relevant budget support. Currently in the APEC region, most of the education and training programs still center around developing and educating young professionals within the formal school systems, or providing professional development trainings for intermediate-level professionals, rather than enhancing awareness and understanding of standards among the general public.

In this sense it is also important to engage with the national education infrastructure when designing and implementing curricula for standards education. Examples include Korea's 'learning for life' program that operates at primary, secondary and tertiary education levels.

Students also can learn a lot through internship programs by experiencing the frontline of standardization activities at the NSBs or other regional, national standardization organizations. Students, especially at the tertiary education level, may participate in the program to be placed within NSBs and to undertake assignments on standardization topics as part of their qualifications. In addition, formal and informal mentoring programs at the NSB for both internal staff and 'young leaders' from stakeholder groups may further facilitate the cycle of recruitment.

In addition, for developing economies, it is important to take advantage of ISO and IEC funding programs. Notably, for example, they may use twinning arrangements on standards communities that allow the transfer of experience and knowledge.

Chapter 6. Standardization Strategy and Performance

Standardization strategy is an indispensable feature of a country's **national competitiveness and innovation policy** (Fraunhofer ISI, 2007; DIN, 2010; O'Sullivan & Brévignon-Dodin, 2012). The ability to access and implement standards through a well-functioning standards infrastructure is directly related to the capability of businesses to quickly **translate innovative ideas** into products, processes and services in the global market (DIN, 2010). Particularly, rapid technological changes in today's world call for an open technological platform where the development of **emerging technologies** can be spurred through dynamic cross-sectoral innovations (O'Sullivan & Brévignon-Dodin, 2012). The standardization strategy is a catalyst to the establishment of this platform (Swann, 2010), for example, by lowering barriers to entry into high-tech ICT industries and promoting the efficiency of knowledge and technology transfer across different sectors.

In this sense, a country's standardization policy is a **strategic instrument** to achieve one's industrial development and competitiveness positioning. As a blueprint to this effort, **a national standardization strategy** should articulate a goal-oriented vision as well as a clear steering point to plan, align, implement and evaluate standardization activities at a national level as well as at a sectoral level.

Key issues concerning the formulation and implementation of a national standardization strategy have been identified and examined in previous literature (Swann, 2000; 2010; Fraunhofer ISI, 2007; O'Sullivan & Brévignon-Dodin, 2012). Notably, the importance of building **a strategic link between standardization and national R&D** has been well-recognized. It would create a virtuous cycle in which both R&D institutes and industry act together to reduce the distance between the two at the national and sectoral levels. Furthermore, a standardization strategy is increasingly considered as a means to foster national competitiveness in addressing **emerging global issues**.

Against this backdrop, this chapter discusses the APEC member economies' standardization strategy and performance. In order to examine how standardization is coordinated at the national level with a strategic purpose and what arrangement is made to link standardization and R&D, the *SI Survey* asked the following three questions:

1. Do you have any strategic and implementation plans for standardization at the national level?

2. The link between R&D and standardization is increasingly important from a strategic perspective. To connect economy's R&D outcomes to standardization, what do you do?

3. What do you do to evaluate the performance of strategic and implementation plans?

This chapter is organized according to the above three questions. For each question, an analysis of the *SI Survey* responses is presented first, followed by discussions on key issues and notable cases.

6.1. Standardization strategy at the national level

Most of the responding economies (12 out of 15) except Australia and New Zealand set up a strategic plan for standardization at the national level. Table 1 shows details of the current plan of each economy.

[Table 4] National standardization strategies of the participating APEC economies

Economies	Plan		Period
Australia	No	-	
Canada	Yes	Action Plan on Standardization Activities in Support of Government of Canada Priorities	2011-2012 (annual)
Hong Kong, China	No	-	
Indonesia	Yes	Strategic Plan	2010-2014 (5yrs)
Japan	Yes	Intellectual Property Strategic Program	2012 (annual)
Republic of Korea	Yes	The 3rd Basic Plan for National Standards	2011-2015 (5 years)
Malaysia	Yes	• National Standards Strategic Action Plan • 5 Year Strategic Plan • Annual Business Plan	
Mexico	Yes	National Standardization Plan	Annual
New Zealand	No	-	-
Peru	Yes	National Standardization Strategic Plans	2013-2015 (3 years)
The Philippines	Yes	N/A	
Singapore	Yes	Standards Council Strategic Plan	3 years
Thailand	Yes	Strategic Plan	2011-2015 (5 years)
The United States	Yes	United States Standards Strategy	
Viet Nam	No	Draft - National Standardization Strategy[34]	2006-2007

The Survey shows that in Australia and New Zealand, a specific national level strategic plan does not exist, while the NSB or an equivalent government agency performs a similar planning activity on a smaller scale. In case of Australia, Standards Australia is not in a

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[34] Following the enactment of the Law on Standards and Technical Regulation, the Vision 2020 states that a strategic plan and implementation plans for standardizations will be prepared at the national level by 2020.

position to cover the full spectrum of standards planning for the economy, although it does develop an annual plan of business for the organization. In New Zealand, no specific plan for national standardization is published. However, the annual review conducted by the Ministry of Business, Innovation and Employment (MBIE) on the national standards and conformance infrastructure is comparable to a strategic planning. These two cases indicate that their NSBs' mission and competency lie in serving for standards implementation and dissemination but not for strategic planning from an overarching perspective, considering that broader strategizing happens at the level of the relevant Ministry.

The rest of the responding economies have national strategic plans for standardization in various formats. They share similarities and differ in some aspects.

First of all, the strategic plans, despite varying objectives and formats, contain **components** such as vision statement, national inventory of current standards policies, regulations, and standards development activities, standards institutions, existing standards in use, education, budget, role/ responsibilities of NSB, etc. Among others, the commitment towards a **common international standardization** goal is expressed in strategic plans of a number of economies. For example, the UL in the United States prioritizes the use of international standards to minimize technical barriers to trade. The KATS in Korea mentions the importance of developing an international cooperation plan on the use of international standards as well as increasing its participation in the international standards setting process.

A notable comparison can be made regarding the **approaches** taken by the government in the planning process. In some economies, the government is in the driver's seat to orchestrate the planning in a top-down manner, as illustrated in the example of Korea. In other cases, a decentralized approach is taken to cherish the value of diversity in national standardization planning, for which the United States provides a good example.

In Korea, the leadership role of the government in national standardization planning is assumed on a legal basis. The Framework Act on National Standards, which came into force in 2000, provides that the government establish and enforce the Basic Plan for National Standards in every five year. The Basic Plan is then reviewed by the National Standards Deliberative Committee, which is also established by the government. Once the Committee agrees on the Basic Plan at the national level, individual ministries establish their own annual Implementation Plan for National Standards respectively, based on the key principles in the Basic Plan.[35] Naturally, the priority areas of standards development are set by the government in consideration of the overall national industrial competitiveness. In these circumstances, standardization activities can be connected with national R&D activities with ease.

On the other hand, the United States exhibits a case where the national standardization

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[35] The first Basic Plan for National Standardization was established in 2001, and the current plan is the third one for the years 2011-2015.

strategy expresses a broad vision and ideals of a sector-based, decentralized approach. The United States Standards Strategy (USSS), a revision of the National Standards Strategy for the United States (NSS) approved in 2000, guides how the United States develops standards in full reflection of the diversity in the U.S. standards system. Rather than stipulating specific goals and objectives of the national plan or defining the scope and responsibilities of stakeholders, the Strategy provides a template framework packed with strategic and tactical initiatives, which can be used by diverse interests to meet their own national and individual organizational goals. It is also noteworthy that the Strategy was developed through the coordinated efforts of a large group of diverse stakeholders representing the government, industry, standards developing organizations, consortia, consumer groups, and academia.

The variation found between the centralized approach and the decentralized one to the development of standardization strategy reflects different characteristics of standards infrastructure in each economy. While the top down approach can be advantageous to ensure the consistency of policy design and implementation throughout the entire economy, the decentralized model has its merit in enabling a variety of sector-specific solutions to emerge.

In addition to spelling out an overarching vision and framework, a national standardization strategy should address **sector-specific standardization plans** (O'Sullivan & Brévignon-Dodin, 2012). A sectoral approach allows a customized integration of standardization and industrial development. Particularly, amid the burgeoning competition in **emerging technologies**, many advanced economies have been applying a sectoral standardization plan as a tool to incubate and support new innovations, which is then integrated into technology-related business opportunities to further infuse life into the entire economy.

The discussions during the Medan Workshop revealed that a number of APEC economies have already set up standardization plans for Emerging Technologies, developed either by NSBs or other agencies. For example, in the United States, NIST has developed a standardization plan to support the smart grid roll-out under the umbrella of UL (NIST, 2012). ANSI also has a standardization plan to support the ever-competitive electronic vehicle industry in the United States (ANSI, 2013). In Malaysia, DSM has developed sectoral standardization plans to support a high-level economic transformation programme in twelve sectors of strategic importance (PEMANDU, 2013). KATS and Standards Australia have set up similar measures to increase the involvement of academia in standardization activities, in an effort to secure industry buy-in on new standards developed for the emerging industries. These examples represent the NSBs' efforts to swiftly adapt to the changing market and technological environments by incorporating innovative technology sectors.

By and large, the goal of national standardization strategy lies in providing a necessary condition for industries to optimize the use of standardization. With this in mind, national standardization plans should involve sector-specific approaches to identify strategic needs, market trends, and environmental and operational conditions, where standardization solutions can be used to support key industry sectors of the economy, including the emerging

technologies sector.

6.2. Link between standardization and R&D

A linkage between standardization and R&D is an important component to an economy's development in that standards can expand and grow the market, both domestic and international, for the products developed from R&D activities, and that R&D outcomes isolated from the dominant (or emerging) standards in the market may remain sterile technological achievements (DIN, 2010). Knowledge of regional and international standards and standardization is essential in developing, producing and providing products and services which are sold and acceptable in those regional and global markets. Therefore, R&D for new products and services should take into account standards and standardization. In emerging technologies, furthermore, innovative products and services need to be developed considering what other technologies (or standards) are being developed (Blind, 2013). Otherwise the technology (or standards) developed at a huge cost cannot be adopted in the market. Accordingly, R&D activities need to be conducted on full alert to global standardization trends.

Regarding current efforts to connect an economy's R&D outcomes to standardization, most of the responding economies agree with the importance of such a link. In principle, such a link helps utilize standardization in implementing innovations and R&D results, while aligning the national R&D agenda in tune with the changing needs of the market. However, there is a general recognition that a gap continues to exist between the principle and the practice.

The key issues brought up in the survey boil down to two questions: how to encourage researchers to get involved in the standardization process, and how to incorporate standardization into R&D projects as an integral part. Considering that the linkage between R&D and standardization is a mutual process of knowledge and technology transfer (Fraunhofer ISI, 2007), the two tasks, in essence, should be understood as two sides of the same coin. For example, by establishing a set of R&D evaluation criteria which recognizes standardization as an important outcome, JISC in Japan provides an incentive for researchers to consider standardization as a part of their job descriptions. The policy, one originally developed to strengthen and monitor the quality of R&D result, effectively serves as a policy to support standardization as well.

Given this understanding, Box 13 below provides two examples of policy measures implemented in Korea, in order to stimulate the mutual exchange of ideas and practice between R&D and standardization.

<Box 17> **Korea: Standards Program Director and National Standards Coordinator**

Developing a close link between standardization and R&D is increasingly important. The case of Korea deserves attention in terms of strategies connecting R&D to standardization. Since 2008, KATS has been implementing the liaison between R&D and standards to promote the commercialization of developed technology and its market expansion. As part of these efforts, Standards Program Director and National Standards Coordinator have been implemented to strengthen the link between R&D and standards.

Standards Program Director

The then Ministry of Knowledge Economy (now the Ministry of Science, ICT and Future Planning) introduced the R&D Program Director system in 2009. This system allows non-government experts, so called the PDs of various fields, to engage in and be responsible for the full cycle of R&D projects including the process of planning, assessment, operation, technology transfer and commercialization. R&D Program Directors were selected in fields such as IT convergence technology, RFID/USN, software, u-computing, knowledge information security and energy resources.

Along with PDs in these fields, Standards Program Directors were appointed in three areas: information and communications, new industry and core industry, and energy. They work for the connection of technology development and standardization. From the beginning stage of R&D planning, the directors have responsibilities to review the liaison between R&D and standardization, analyze standardization patterns in R&D-related fields through network building among standards experts, and support international standardization activities of participating researchers. The Standards Program Director system aims to remove market entry barriers through standardization and to penetrate into the international market by connecting R&D and standardization from the initial stage of each activity.

R&D-standards-related projects by Program Director field (2009)

No. of projects	IT convergence technology	RFID /USN	Next generation mobile communication	BcN	DTV	u-computing	Knowledge information security	Home network/ information appliances
R&D projects	13	10	10	8	20	6	6	5
R&D-standard-related projects	3	1	3	3	9	2	2	2

*percentage of R&D-standard related projects = 31%

National Standards Coordinator

The National Standards Coordinator (NSC) was launched in 2011 by the Korean Agency for Technology and Standards (KATS). The National Standards Coordinators refer to private experts appointed by KATS. They are responsible for the management and coordination of national standards and the international standardization of Korean technologies. The NSC system is aimed at strengthening the linkage between government R&D efforts and standards, and facilitating the industrialization of developed technologies. This is especially important for Korea, which has a high ranking of R&D investment but suffers from a huge technology trade deficit that arises from technology royalties and the lack of international standardization of homegrown technologies.   (cont'd)

(cont'd)

In 2011, NSCs were appointed in smart grid, nuclear energy, 3D industry, cloud computing, smart media and electric cars. In 2012, new NSCs were appointed in the areas of smart grid, smart logistics and printed electronics, in which Korea is expected to lead international standardization.

Responsibilities of the National Standards Coordinator are as follows:

1) Establishing National Standardization strategies and the standardization roadmap,

2) Planning and discovering standardization tasks of core technologies,

3) Participating in planning and evaluating standardization of R&D tasks to accelerate a better liaison between R&D and standardization,

4) Promoting standardization cooperation among international R&D researchers and supporting standards applications, and

5) Recommending international standards to homegrown companies and supporting international cooperation projects for technology and standards

Source: www.kscodi.or.kr

A close connection between R&D and standardization can lead to opportunities for trade and the development of the industry concerned, by making the industry's products and services accessible to the regional and global market where the standards are accepted. It can expand the market for the industry. However, not many researchers in national R&D systems participate in standardization as standardization is not actively perceived as a potential field of their activity and development. Therefore, schemes to increase researchers' awareness on the significance of standardization and thereby to facilitate their participation need to be developed. One way for this is to increase the weight given to standardization participation and standards development in the evaluation of researchers' performance in R&D institutes. Furthermore, as shown in the cases of Korea and the United States, the exchange of personnel between R&D institutes and NSBs may further facilitate building a closer relationship between R&D and standardization.

6.3. Evaluation of the performance of strategic and implementation plans

With respect to the evaluation and monitoring of standardization plans, there are not many policy examples that can be pulled from the survey responses. It is in part because most of the plans have recently started, and in part because they are not subject to any formal performance evaluation.

In light of the **type of performance evaluation**, the responding economies most commonly mention the annual performance evaluation of the NSB. The evaluation result, in some economies, is converted into a set of **key performance indicators** so that appropriate adjustments can be made during the course of implementation as well as for the next round of strategic planning. For example, some measurement criteria may include: 1) engagement in standardization measured in both qualitative and quantitative methods, 2) development of standards, in terms of numbers and the ability to meet stated needs, and 3) production of standards including access to documents and dissemination.

On top of a full scale annual performance evaluation, some economies cite monthly or quarterly monitoring as **supplementary tools** to ensure that implementation is on the right track towards achieving the set goals. Notably in Korea, **a participatory evaluation** is conducted by a 50-member citizen panel, representing general citizens including consumers and industry. The panel evaluates the performance of strategic and implementation plans according to the evaluation criteria laid out by the five-year Basic Plan for National Standards. The result of the evaluation is then reflected in the next round of Basic Plan development and in the performance evaluation of relevant departments and their staff's performance-based bonus.

Aside from the performance evaluation, economies such as Australia, Singapore, and the United States have put in place **complementing programmes** to assess the achievement and improve future performance. For example, SPRING Singapore has implemented the

Balanced Scorecard framework to identify key strategies and implementation measures for particular standardization goals.[36] In the same fashion, the UL/United States has developed case studies to measure the impact and outcomes of specific standards in a qualitative manner, so that the result can help carving out customized implementation strategies. In another example, the Standards Australia has introduced the "Net Benefits" framework to quantify the net benefits of standards before the standards are developed or reviewed.[37]

By all means, the ongoing assessment and improvement of the standardization plans is critical in order to further enhance the role of standards as an essential ingredient to promoting economic and industrial innovations. However, the evaluation is not yet formally implemented in many economies. The processes and instruments for evaluation need to be further developed and put in place.

6.4. Recommendations

This section has described the current status of standardization strategy and performance evaluation in APEC economies, focusing on how different economies develop national and sectoral standardization plans, how some economies try to build a strategic link between R&D and standardization, and last but not least, how they evaluate the performance.

Depending on the institutional context and history of an economy, and the characteristics of related industries, a national standardization strategy emanates from high-level government agencies in some economies, while in others it is formulated under a decentralized, industry-specific setting. National level strategies should accompany arrangements appropriate to develop sector-specific standardization plans. The national standards strategy includes the following elements:

> *Vision statement; national inventory of current standards policies, regulations and standards development activities; standards institutions; existing standards in use; budget; role and responsibilities of NSB, etc.*

In order to facilitate a tight integration of R&D and standardization, the following policy options can be considered:

- *Increase formal outreach to research and academic communities and efforts to increase their participation in standards activities,*

- *Promote joint research projects,*

- *Encourage the sharing of facilities of R&D and standardization organizations,*

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[36] For more information, see:
http://www.spring.gov.sg/QualityStandards/be/Documents/BE_Framework.pdf
[37] For more information, refer to the latest annual report of the organization available at :
http://www.standards.org.au/OurOrganisation/AboutUs/Documents/SA-AR2012.pdf

and

- *Monitor current R&D trends and activities to better align standardization strategies*

For the most part, the evaluation of the performance of strategic and implementation plans is conducted within the scope of the annual performance evaluation of the NSB. However, on top of the NSB evaluation, it is important to formalize a separate evaluation system for standardization strategies. Key performance indicators may include the following:

Engagement in standardization; development of standards; production of standards, outreach activities, etc.

In addition, supplementary measures can be adopted to strengthen the formative nature of evaluation such as case study development and participatory evaluation programme.

PART
03

CONCLUSION

Chapter 7. Guidelines

This chapter highlights some important findings and recommendations on national standardization infrastructure that have emerged throughout this report. These observations are presented in a set of guidelines on standards infrastructure building, for the purpose of achieving greater alignment of national standards infrastructure among the APEC economies.

However, due to the limitations in the data availability combined with the unique circumstances of each economy, it is impossible, and even not desirable, to draw out generalizable principles for standards infrastructure development. With this in mind, this guideline is not a comprehensive to-do list but a checklist -- a source of reference on standardization activities based on what some of the APEC economies are actually doing.

In the following sections, issues of emerging and continuing importance are presented by the five thematic areas discussed in the previous chapters.

7.1. Organization of NSBs

Approaches to institution-building of standards infrastructure

A private-led NSB has its strength in the openness and flexibility of the NSB which in turn allows a greater room for industry participation and bottom-up innovation. A government-led model, on the other hand, is more advantageous to plan and coordinate various stakeholders and their activities for the maximum benefit of the economy.

Core functions of an NSB may include some of the following:

- Developing standards

    - Prioritization of standards development should fairly reflect the needs of the industry and the public.

- Supporting the implementation and use of standards within an economy

    - This may entail a wide variety of activities, from implementation of specific policies and/or regulations based on or otherwise regarding standards, to provision of information for the general public, industries, expert communities, as well as policymakers.

- Liaising with international, regional or sub-regional standards bodies as a national representative

    - An NSB should serve as a facilitator of the global trade by harmonizing national

standards and related technical regulations with international practices, and thereby reducing the incidence of standards becoming technical barriers to trade.

- Raising awareness of the public on the value of standards

  - It is important to provide seminars and information services to support new standards and implement communication and public affairs plan.

<u>Supporting and collaborating organizations to NSBs</u>

In some cases, supporting and collaborating organizations, on behalf of an NSB, directly or indirectly engage in policy implementation and standards development process. A key to the successful supporting activities entails engagement and participation of stakeholders and experts. In this regard, the following can be considered in order to create and institutionalize avenues of participation:

- Developing partnerships, i.e. entering into collaboration MoUs with research, private sectors

- Holding general engagement events, and maintaining an ongoing communication channel between the NSB management and the stakeholders including the technical experts

- Employing periodic surveys and market research reports to understand the sector-specific needs and the perception of effectiveness of the NSB regarding the standards development process

<u>Technical Committees</u>

TCs are where the technical expertise in the industry are crystalized into codified knowledge. The following can be considered for the formation and operation of TCs.

- Setting standardized principles

  - It is important to create and maintain balanced TCs that bring in the right expertise while no single interest dominates the deliberation process. The principles should set out the guidelines of open, fair representation and impartiality and consensus in its decision-making.

  - *i.e. Two-tier system for technical committees, Korea, Box 3*

- Encouraging a culture that values committee participation

  - It is important to improve contributors' recognition, promote value and benefits of standardization, develop and refine committee tools and processes to support ease of engagement. In addition, committee training programs and awards programs can be considered to recognize and encourage participation.

7.2. Budget and business model

<u>Securing financial resources</u>

● For NSBs as a government agency, the most important funding comes from the government budget. In this case, it is important to raise awareness of policymakers and appeal to the Parliament or the authority in charge for sufficient funds.

    - Prioritizing the standards development and incorporating the goal into the economy's national agenda: *i.e. Strategic Reform Initiative, Malaysia, Box 6*

● NSBs as a private agency need to diversify the revenue streams, and avoid too much reliance on a single or limited revenue source such as the sales of standards. The following value-added services can be considered for revenue diversification:

    - Product and system certification, provision of specialized trainings, consultancy and other services, i.e. standardization roadmaps for priority areas, policy advice on trade agreements, i.e. texts of technical regulation in relation to the WTO/TBT, capacity-building projects for developing countries and emerging markets, and subscription fees from industry members.

<u>Demonstrating the value of standardization for long-term viability</u>

It is important to demonstrate the value of standardization activities to those who make funding and investment decisions such as the government and industry, for the long term development of, and investment in, national standards infrastructure. Particularly, the engagement of private industry is not only imperative in a political sense, but is also advantageous from the economic perspective as the private sector may and should eventually share the costs of standards development.

7.3. Standards implementation and dissemination

<u>Application of national standards into technical regulations</u>

Standards provide advantages to the formulation of technical regulations in terms of the technical and administrative perspectives. However, as the WTO TBT Agreement stresses, inappropriate implementations of mandatory standards may cause unnecessary obstacles to international trade.

● Developing guidelines on how to use and reference standards for technical regulations

    - These guidelines may maximize the benefits of utilizing standards as a basis for technical regulations while reducing the potentially negative outcomes.

    - *i.e. Guidelines for using and referencing standards for technical regulations, Korea,*

p.28

- *i.e. How are standards used in policy and legislation, New Zealand, Box 8*

- *i.e. The Use of International Standards in Technical Regulation, OECD, Box 10*

<u>Certification system and TBTs</u>

The compliance with technical regulations – mandatory national standards – requires a certain form of confirmation, which may be obtained through testing, certification or inspection by laboratories or certification bodies.

- Participating in mutual recognition arrangements (MRAs)

  - MRA is a key policy instrument of trade facilitation and cost reduction in the regional as well as the global economies, which exemplifies the efforts to comply with internationally recognized guidelines when operating their conformity assessment systems.

  - *i.e. APEC-wide MRAs including APEC TEL MRA and EEMRA, Box 11*

<u>Dissemination</u>

With the advancement of ICT in recent years, the major channel of dissemination has gradually shifted towards online initiatives. This reflects the efforts to increase the accessibility of standards. The following can be considered for greater outreach.

- Implementing ICT strategy for NSBs to better engage with stakeholders through online means, for example, online participation tools, websites or web portals through which key information services and online sales of standards documents take place

  - *i.e. Korean Standards Information Center and Korean Standards Service Network, p.39*

  - *i.e. National Resource for Global Standards, ANSI, United States, p.40*

- Operating the Technical Barriers to Trade (TBT) Enquiry Point for trade facilitation

  - *i.e. KNOW TBT website, Korea, Box 12*

7.4. Professional (HR) development

<u>Training and education programs</u>

HR development strategy should target different groups of people, including standards professionals, the users of standards in the industry, as well as the general public, government officials and scholars.

- Standards education in formal school systems

  - This type of education should be geared towards raising awareness of the general public as consumers of standards and raising awareness of the public as a foundation of national standards infrastructure

  - *i.e. Learning for life program that operates at primary, secondary and tertiary education level, Korea, Box 13*

  - *i.e. ANSI Committee on Education , United States, Box 14*

- Standards education/training for working professionals

  - This may include trainings for current professionals conducted outside the boundary of formal education

  - *i.e. Training programs for technical committee members, committee chairs or conveners, or secretaries, notably aimed at strengthening the capacities required for participating in international standardization activities, Korea, p.51*

  - *i.e. For emerging economies where technical knowledge and infrastructure on standards are somewhat limited to develop training programs on their own, regional or other bilateral, multilateral cooperation programs on standards education may provide a solution, INDECOPI /Peru and Canada, p.51*

Skillsets and qualification schemes

From the institutional perspective, a qualification scheme for standards professionals helps: 1) to evaluate the existing skills and knowledge of standards-related human resources, 2) to define the tasks, processes and methodologies related to standardization activities, and 3) to inform and share those tasks within the organization, by setting a target of education, and developing education programs tailored to the identified needs.

- Programs may include areas in strategy/ planning, development, application/ implementation, promotion. Examples of qualification systems include the following:

  - *i.e. Certified Standards Professional, KSA , Korea, pp.51-53*

  - *i.e. Standards skills indicator, JISC, Japan, pp.53-55*

Programs for engaging professionals and academics

Successful HR management requires efforts to recruit, retain and engage with talents. IT is important to ensure that there are formal mechanisms and expectations for knowledge transfer, i.e. through training of trainers.

- Supportive programs to boost professionals' engagement in standardization activities such

as annual award, financial support for international standardization activities, and networking events   *i.e. p.56*

● Recruitment programs for young talents may include:

- Raising awareness and promoting the profession of standardization by having dedicated promotion materials and a 'Career' tab on the NSB website.

- Providing specialized recruitment opportunities for entry-level positions,

- *i.e. Young Leaders Program of Standards Australia, Box 15*

- *i.e. The program for human resource development and technical standards of KSA, Box 16*

7.5. Standardization strategy and performance

<u>National standardization strategies</u>

The goal of national standardization strategy lies in providing a necessary condition for industries to optimize the use of standardization. An economy's standardization should articulate a goal-oriented vision as well as a clear steering point to plan, align, implement and evaluate standardization activities at a national level as well as at a sectoral level.

● Key Components of national standardization strategy

- Vision statement, national inventory of current standards policies, regulations, and standards development activities, standards institutions, existing standards in use, education, budget, role/ responsibilities of NSB, etc.

- *i.e. The United States Standards Strategy, pp.63-64*

● Sectoral strategies should focus on emerging global issues and new technology, reflecting the economy's industrial competitiveness

- *i.e. ANSI Electronic vehicle standardization plan, the United States, p.64*

- *i.e. Malaysia DSM Sectoral policy, p.64*

<u>Link between standardization and R&D</u>

It is important to encourage researchers to get involved in the standardization process, and to incorporate standardization into R&D projects as an integral part. The following can be considered:

● Developing a standards framework to align with government policies and business needs

- Monitor current R&D trends and activities to better align standardization strategies

- *i.e. Standards Program Director and National Standards Coordinator, Korea, Box 17*

● Implementing a collaboration plan with universities and exchanging personnel between R&D institutes and NSBs to facilitate joint research projects

- Increase the weight given to standardization participation and standards development in the evaluation of researchers' performance in R&D institute, *i.e. p.68, Korea*

<u>Evaluation of the performance of strategic and implementation plans</u>

● Key performance indicators for NSB evaluation may consider the following categories:

- Engagement in standardization measured in both qualitative and quantitative methods

- Development of standards, in terms of numbers and the ability to meet stated needs

- Production of standards including access to documents and dissemination

● Supplementary tools to assess the achievement and improve future performance

- *i.e. Participatory evaluation, Korea, p.68*

- *i.e. Balanced Scorecard framework to identify key strategies and implementation measures for particular standardization goals, Singapore, pp.68-69*

Chapter 8. Concluding Remarks

Strengthening an economy's standards capacity is a good way to develop industries and drive economic growth. By sharing information on how other economies have established and implemented their policies and strategies, this guideline would help the APEC economies save efforts and minimize mistakes in carrying out their standardization activities. It also helps reduce inefficiencies and confusion resulting from different standardization systems in the region, notably by reducing incidence of standards becoming technical barriers to trades. In addition, this report would enhance partnerships among advanced and emerging economies in the region, and contribute to providing appropriate assistance to developing economies to keep up with the international standardization trend on their own. It is also hoped that this report makes an impact on regional trade by promoting better alignment in standards and related regulations as well as strengthening cooperation in standardization activities for common benefits in the region.

However, it should be noted that this report, due to some limitations in data collection and the limited coverage of the survey (i.e. 15 economies participating out of the total of 21 APEC member economies), does not provide a comprehensive view of standards infrastructure in the region and does not offer generalizable prescriptions for problems facing decision-makers. Nevertheless, the findings drawn from this attempt bear a certain degree of relevance applicable to economies in different stages of standardization capacity development, and offer a reference by which policy makers in each economy can assess the progress of their economy by themselves for further improvement.

Last but not least, the scope of this research is confined to the standards infrastructure of APEC economies. It does not include the national conformity assessment systems. Considering that a greater number of TBTs arise from the differences in national conformity assessment systems, future research should pay due attention to the conformity assessment and certification systems in APEC economies.

Bibliography

ANSI, 2013. *Standardization Roadmap for Electric Vehicles,* s.l.: Electric Vehicles Standards Panel, American National Standards Institute.

APEC SCSC, 2005. *Blueprint APEC SCSC.* s.l.:Ministry of Economy and Energy, Chile, APEC Secretariat.

APEC(a), 2013. *2013 APEC Leaders' Declaration.* [Online]
Available at: http://www.apec.org/Meeting-Papers/Leaders-Declarations/2013/2013_aelm.aspx
[Accessed 29 October 2013].

APEC(b), 2013. *"Support for good regulatory practices in APEC will foster growth", Medan, Indonesia, APEC Subcommittee on Standards and Conformance.* [Online]
Available at: http://www.apec.org/Press/News-Releases/2013/0627_growth.aspx
[Accessed 29 October 2013].

APEC(c), 2013. *"APEC experts seek alignment of standards to boost business", Medan, Indonesia, APEC Sub-Committee on Standards and Conformance.* [Online]
Available at: http://www.apec.org/Press/News-Releases/2013/0623_business.aspx
[Accessed 23 October 2013].

APEC, 2012. *Guideline for MRA ETR Implementation.* [Online]
Available at: http://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Working-Groups/Telecommunications-and-
Information/~/media/Files/Groups/TEL/MRA/20121018_GuidelinesForImplementingMRA-ETR.DOC
[Accessed 13 November 2013].

APEC, 2013. *Human Resources Development.* [Online]
Available at: http://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Working-Groups/Human-Resources-Development.aspx
[Accessed 25 November 2013].

Blind, K., 2013. *The Impact of Standardization and Standards on Innovation: Compendium of Evidence on the Effectiveness of Innovation Policy Intervention,* Manchester: Manchester Institute of Innovation Research, Manchester Business School, University of Manchester.

BSI, 2013. *Information about standards: British Standards Institution.* [Online]

Available at: http://www.bsigroup.com/en-GB/standards/Information-about-standards/
[Accessed 12 November 2013].

Choi, D. & de Vries, H. J., 2011. Standardization as emerging content in technology education. *International Journal of Technology and Design Education,* 21(1), pp. 111-135.

de Silva, S., 1997. *Human Resources Development for Competitiveness: A priority for employers,* s.l.: International Labour Organisation.

de Vries , H. J. & Egyedi, T. M., 2007. Education about Standardization: Recent Findings. *International Journal of IT Standards and Standardization Research,* 5(2), pp. 1-26.

de Vries, H. J., 2011. *Implementing Standardization Education at the National Level,* s.l.: Erasmus Research Institute of Management (ERIM).

DFAT, 2013. *The APEC Region - Trand and Investment,* s.l.: Trade Advocacy and Statistics Section, Department of Foreign Affairs and Trade, Australia.

DIN, 2010. *The German Standardisation Strategy: an update – Focus on the Future,* Berlin: DIN German Institute for Standardization.

Ernst, D., 2012. *America's voluntary standards system – a best practice model for innovation policy?,* s.l.: East-West Center Working Papers Economics Series, No. 128.

Fliess, B., Gonzales, F., Kim, J. & Schonfeld, R., 2010. *The Use of International Standards in Technical Regulation,* s.l.: OECD Publishing.

Fraunhofer ISI, 2007. *INTEREST Final Report: Integrating Research and Standardisation,* s.l.: European Commission.

Government of New Zealand, 2013. *New NZ Standards system announced.* [Online]
Available at: http://www.beehive.govt.nz/release/new-nz-standards-system-announced
[Accessed 15 December 2013].

ISO, 2013. *Who develops ISO standards?.* [Online]
Available at: http://www.iso.org/iso/home/standards_development/who-develops-iso-standards.htm
[Accessed 12 November 2013].

ITU, 2009. *Bridging the standardization gap — ITU–T Research Project: Measuring and Reducing the Standards Gap,* Geneva: ITU.

JISC, 2013. *Skill standard - Evaluation for skills of human resource required for standardization.* [Online]
Available at: http://www.jisc.go.jp/policy/skill/docs/english.pdf
[Accessed 25 November 2013].

Kurokawa, T., 2005. Developing Human Resources for International Standards. *Science & Technology Trends, Quarterly Review 17,* October.pp. 34-47.

Laking , R., 2012. *Crown entities - How are Crown entities governed? - Te Ara - the Encyclopedia of New Zealand.* [Online]
Available at: http://www.TeAra.govt.nz/en/crown-entities/page-3
[Accessed 12 November 2013].

Lynch, C. A., 1999. The Case for New Economic Models to Support Standardization Efforts. *Information Standards Quarterly,* April, 11(2), pp. 5-10.

NIST, 2012. *NIST Framework and Roadmap for Smart Grid Interoperability Standards,* s.l.: National Institute of Standards and Technology, the U.S. Department of Commerce .

O'Sullivan, E. & Brévignon-Dodin, L., 2012. *Role of Standardisation in support of Emerging Technologies,* Cambridge, United Kingdom: Department of Business,Innovation & Skills, United Kingdom (BIS) and the British Standards Institution (BSI).

OTA, 1992. *Global Standards: Building Blocks for the Future, chapter 2, "Standards Setting in the United States", page 39,* Washington DC: Office of Technology Assessment, Congress of the United States.

Oxford, 2013. *"business model.".* s.l.:Oxford.

PEMANDU, 2013. *Competition, Standards and Liberalisation (CSL), Malaysia.* [Online]
Available at: http://etp.pemandu.gov.my/International_Standards_-%E2%97%98-_Liberalization-@-Competition,_Standards_and_Liberalisation_(CSL).aspx
[Accessed 15 December 2013].

Steiss, A. W. & Nwagwu, E. O., 2001. *Financial Planning and Management in Public Organizations.* New York: Marcel Dekker.

Stephenson, S. M., 1997. *Standards, Conformity Assessment and Developing Countries.* [Online]
Available at: http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-1826

Stiller, B. et al., 2010. *Internet economics V,* Zurich: Department of Informatics (IFI), University of Zurich.

Swann, G. M. P., 2000. *The economics of standardization: Final Report for Standards and Technical Regulations Directorate, UK Department of Trade and Industry,* Manchester: Manchester Business School.

Swann, G. P., 2010. *The Economics of Standardization: An Update,* s.l.: UK Department of Business, Innovation and Skills (BIS), Innovative Economics Limited.

TEL, A., 2001. *A guide for conformity assessment bodies to the APEC TEL Mutual Recognition Arrangement.* [Online]
Available at: http://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Working-Groups/Telecommunications-and-Information/~/media/Files/Groups/TEL/MRA/mra%20guide%20for%20assessment%20bodies.pdf
[Accessed 13 November 2013].

Treasury Board of Canada Secretariat, 2005. *Review of the Governance Framework for Canada's Crown Corporations - Meeting the Expectations of Canadians,* s.l.: Treasury Board of Canada Secretariat.

UN, 2011. *Human Resources Development: Report of the Secretary General.* [Online]
Available at:
http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N11/436/27/PDF/N1143627.pdf?OpenElement
[Accessed 24 November 2013].

UNIDO & ISO, 2008. *Fast forward - National Standards Bodies in Developing Countries,* s.l.: ISO & UNIDO.

Wijkström, E. & McDaniels, D., 2013. *International Standards and the WTO TBT Agreement: Improving governance for regulatory alignment,* Geneva: Economic Research and Statistics Division, World Trade Organization.

World Bank, 2011. *Harnessing Quality for Global Competitiveness: Upgrading Eastern Europe and Central Asia's Quality and Standards.* Washington, D.C.: The World Bank.

WTO, 2013. *Technical Information on Technical barriers to trade.* [Online]

Available at: http://www.wto.org/english/tratop_e/tbt_e/tbt_info_e.htm

[Accessed 13 November 2013].

Appendix: SI Survey Questionnaire

SURVEY

Creation of APEC Guidelines on Standards Infrastructure Establishment

❍ Project Information

- ♣ Project Number : S CTI 15 12A
- ♣ Project Title : Creation of APEC Guidelines on Standards Infrastructure Establishment
- ♣ Proposing APEC Economy : Republic of Korea
- ♣ Related Workshop : June 23, 2013 / Medan, Indonesia

❍ Purpose of the Project and Survey

The primary goal of this project is to create APEC guidelines on standards infrastructure establishment and share it with all APEC economies. To achieve the goal, it is necessary to share information on standardization related systems, facilities, environments, and human resources among the economies through this survey and at first and workshop which is planned on June 23, 2013.

In this project, the term of "infrastructure" is defined as systems, facilities, environments, information, and human resources to support/facilitate standardization activities such as standards proposal, adoption, utilization, etc.

Our specific action plans in this project are as follows: 1) To investigate systems and good examples on how to implement and spread out developed standards; 2) To investigate the whole scale of standardization support budgets and how to secure the budgets from the government; 3) To investigate the current statute of standardization-related organizations and their human resources management;4) To investigate systems of nurturing experts in the field of standardization and offering incentives for their accomplishments;5) To investigate how to connect national R&D results in each technology with standardization work

The APEC guidelines created in this project will be useful for the economies in establishing new standardization policy and activities and as a tool for sharing information.

○General Information

- Name of Economy : _____

- Date Submitted : _____

- Organization : _____

- First Name : _____   Last Name : _____

- Email Address : _____   Phone Number : _____

○Questionnaires

Section Ⅰ: Organization

1. What is your National Standards Body?

2. What are the supporting or collaborating organizations of NSB in terms of implementing standardization policy or standards development?

3. How are technical committees organized? And how many are they? How many experts participate in technical committee activities?

Section Ⅱ :Budget

1. What is the budget size for national standardization (i.e. NSB's budget) in your economy? Where does it come from? How much is the standardization budget per head of population?

2. For what is the budget allocated? In other words, for what kind of activities are the budget used (i.e. standard development, training, dissemination, etc.) and how much for each?

3. Do you have any program in your economy in order to secure and increase the budget for the enhancement of national standardization?

Section Ⅲ :Standards Implementation and Dissemination

1. What is the system of applying national standards to technical regulations in your economy?

2. What are the certification systems (product, management system) of national standards in your economy?

3. What is the system for providing standards information and disseminating national standards? How is it running? (i.e. online, offline) How much are used or sold?

Section Ⅳ :Standards Professionals

1. What kind of training and education programs do you have for standard professionals? How many are there and how many trainees are per year?

2. Do you have any qualification scheme for standards professionals?

3. What kind of programs do you have for encouraging and promoting standards professionals' engagement with standardization activities? (i.e. networking programs, remuneration & incentives for career development)

Section Ⅴ :Standardization Strategy and Performance

1. Do you have any strategic plan and implementation plans for standardization at the national level?

2. The link between R&D and standardization is increasingly important from a strategic perspective. To connect economy's R&D outcomes to standardization, what do you do for this purpose?

3. What do you do to evaluate the performance of strategic and implementation plans?