

## Developing Human Resources for International Standards

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### 1 Introduction

Most people would have heard the term, “international standards\*<sup>1</sup>.” However, perception of what it actually means may vary from person to person. Some people may associate it with the form of mechanical parts, such as ISO screws. Others may connect it with ISO 9000, a management standard for quality control. Rather than targeting specific industrial products, ISO 9000 defines the quality assurance processes to be followed by an organization, whether private or public, in providing anything from products to services. There are other types of international standards, such as those covering document exchange formats for business transactions, and more recently, for ebXML and other electronic document exchange formats. Moreover, there are standards for materials<sup>[26]</sup>. In this report, all these standards are collectively referred to as international standards or simply standards\*<sup>2</sup>.

This report does not directly cover curriculum standards such as JABEE (Japan Accreditation Board for Engineering Education). The first reason for this is that these standards have not been a topic of discussion in industrial standardization forums. The second reason is that curriculum standards for higher education like JABEE deserve to be examined in a separate report. That said, there still is a need for curriculum standards to incorporate education aimed at development of international standards experts, and an example of efforts in this direction in Canada is described in this report.

International standards have a 99-year history, dating the 1906 establishment of the International Electrotechnical Commission (IEC). Today, international standards are deemed so important

that it is said, “whoever rules the standards rules the industry”<sup>[1]</sup>. Acknowledging that historical background, this report attempts to shed new light on the topic of developing international standards experts for the following three reasons:

The first reason is economic and industrial globalization. Today, companies around the world are producing goods and services with global markets in mind, which is raising their awareness and appreciation of international standards. They become critical factors governing the ability of manufacturers to secure competitive advantage in international markets<sup>[2, 25]</sup>. This is typified by the World Trade Organization (WTO) Agreement on Technical Barriers to Trade (TBT Agreement)<sup>[3]</sup>, which reinforces the trend of international standards taking precedence over regional and national standards. In the mobile phone market, Japanese companies, which have long adhered to the PDC standard - a domestic format for digital wireless communications - are now facing an uphill battle in competing with overseas rivals. On the other hand, the Europe-originated GSM standard, a digital wireless communications format adopted by more than 100 countries, has proliferated across the world to create a market environment that favors European, North American and Asian companies. Moves toward compliance with the TBT Agreement among Asian countries have, in some extreme cases, led to import prohibitions against Japanese double-tub semi-automatic washing machines, which do not comply with the international standards<sup>[4, 26]</sup>.

The second reason is a change in Japanese companies’ in-house human resource development, more specifically the limitations inherent in traditional human resource development practices based on on-the-job

training (OJT). The prevailing greater emphasis on specialized personnel and short-term profits finds many companies experiencing difficulties in training and developing standards specialists over the long term. The evolving role of standards puts new focus on human resource development. Economic and industrial globalization has brought new perspectives not only to corporate sales and procurement activities, but also to technological development. On one hand, establishment of international standards has allowed companies to expand the markets for their products and services worldwide and to gain greater benefits from mass production. Conversely, manufacturers are now required to take international standards into consideration from as early as the technological development stage. To echo much recent commentary on patents and other intellectual property, companies should not confine discussion of standardization issues to the development stages of individual products or components. Rather, they should effectively define their approach to standardization from a global viewpoint, as part of their overall corporate strategies, which include future visions and goals. Within such a framework, companies can then determine how their organizations will treat standards in individual R&D, sales and procurement projects<sup>[5]</sup>.

The third reason is change in the social environment. As demonstrated by standards on accessibility, standards are beginning to assume new roles, e.g. acting as soft law<sup>\*3</sup> that complements the existing legal system, helps to avoid unnecessary friction between countries, and reduces social burdens. It was not until fairly recently that European countries, the U.S. and Japan began to focus on problems and remedies concerning human resource development in the field of standardization<sup>[6]</sup>. Shortages of human resources in this field are not limited to Japan, but are growing worldwide as standards take on new roles.

Standardization operates on various levels: corporate standards, industry standards, national standards, EU and other regional standards, and international standards such as ISO, ITU and IEC. This report focuses on international standards,

in consideration of the need for globalization and Japan's rather poor capacity in this area. However, a discussion on the content of human resource education naturally extends to personnel involved in corporate standards because the question frequently arises: "How should internal standards be related to broader external standards?"

## 2 Overseas activities in development of human resources for standards

### 2-1 North American activities

#### (1) The United States

In the U.S., the development of industrial standards has been led by the private sector, which is said to be the major difference between U.S. standardization and that of other countries. This simply mirrors other U.S. policy-related activities, given that many U.S. policies have originated with proposals from the private sector and that Congress has played a leading role in deciding to adopt such policies. In other words, private-sector leadership is not specific to standardization activities. Rather, for the U.S., industrial standardization is an area where government involvement is fairly deep, as instanced by certain activities of the Department of Commerce (DOC) and the National Institute of Standards and Technology (NIST), as well as the Department of Defense's involvement in military specification (MIL). From a historical viewpoint, the diffusion of U.S. standards has been driven by government promotion and Pentagon military pressure to establish a war regime<sup>[7]</sup>. The DOC report entitled "Standards & Competitiveness - Coordinating for Results"<sup>[8]</sup>, published in May 2004, describes four new policies and two long-term strategies to advance the Standards Initiative, a project led by Commerce Secretary Donald Evans since March 2003. One of the two long-term strategies is to expand inclusion of standards curricula at engineering and business schools. The other is to partner with colleges/universities on R&D aspects of new technologies and to influence standards at the earliest stages of development of new technologies. A typical example of such industrial standards-related activities at U.S.

universities can be seen in the Center for Global Standards Analysis, which was founded in 1999 at the Catholic University of America, Washington D.C. The Center offers educational courses to law students and engineering students, aiming at a fusion between the humanities and sciences. Employers of those who complete the courses include private-sector companies, standards development organizations, government agencies (including the U.S. Patent Office), and law offices<sup>[9]</sup>.

However, the March 2004 report<sup>[10]</sup> issued by the Center shows that, among U.S. engineering universities, only three offer courses related to standardization: the Catholic University of America (mentioned above), the University of Colorado at Boulder (course discontinued in September 2004), and the University of Maryland. In business schools, no standards-related courses have been adopted so far, although some proposals were put forward in the past<sup>[11]</sup>.

## (2) Canada

In Canada, the Canadian Standards Association (CSA) and the Standards Council of Canada (SCC) have been spearheading promotion of human resource education as an important part of the Canadian Standards Strategy (CSS). In January 2004, CSA and SCC proposed to the Policies and Procedures Committee of the Canadian Engineering Accreditation Board (CEAB) a study on undergraduate curricula related to standardization. The accepted proposal consists of three parts: (1) requirements for the inclusion of standardization issues in engineering curricula, (2) access to standards-related information, and (3) involvement of university instructors in activities related to standardization. Furthermore, the updated edition of the Canadian Standards Strategy for 2005-2008 considers establishment of a Canadian Center for Standardization Research<sup>[12]</sup>. It names as higher priority institutions the University of Western Ontario, the University of Ontario, Queens University, and the University of Waterloo. CSA has also been offering educational programs to its members independently since 1998. As of August 2004, more than 1,300 members had participated in the programs.

## 2-2 *European activities*

The Enterprise and Industry DG of the European Commission regards standardization activities as a key policy. History shows that activities for standardization across national boundaries, including those in commerce, originated in Europe. The issue of how to set a common standard across different languages and systems was first addressed in Europe and then spread to other parts of the world, such as North and South America, Asia, and Africa.

The European Commission's Enterprise and Industry DG also emphasizes building an academic network. It provides a Web page dedicated to this network<sup>[13]</sup>, and lists 20 European universities that offer courses related to standardization (see Table 1). The aim of this academic network is: (1) to promote awareness of standardization at university level, (2) to develop closer cooperation between universities and other institutions, (3) to enhance information exchange, and (4) to enhance knowledge dissemination and exchange of ideas.

In addition to the above, an academic society called the European Academy for Standardization (EURAS), which is headquartered in Hamburg, was established in 1993<sup>[14]</sup>. Moreover, there is an initiative called the Asia Link Project<sup>[19]</sup>, which aims to develop a curriculum on standardization through collaboration between European and Asian universities, as mentioned in the next section.

## 2-3 *Asian activities*

In developing Asian countries, industrial standards are recognized as a pillar of national industrial policy. The Second Northeast Asian (China-Korea-Japan) Standardization Cooperation Seminar, held in Beijing in 2003, named as the sixth article of its trilateral memorandum of cooperation a plan for human resource development for standardization<sup>[15]</sup>. From January 2004, a joint research with European universities started that is described later. In the Third Seminar, held in Tokyo in December 2004, South Korea verbally reported its activities: "In 2004, seminars on standardization was conducted at 11 science and technological universities. For

2005, 30 universities have applied. The seminar targets sophomore to senior students. Since there is no professor specializing in standardization, a team comprising standardization professionals from companies and research institutes gives lectures. We are also planning a standardization education program for high-school students. It will include standardization education for high-school teachers during school holidays.” The memorandum of cooperation signed at the end of the seminar states in “Article 3.

Standardization Education Plan”: “In recognition of the proposal made by China on this issue and the examples of education at science and technological universities presented by South Korea, the three countries have reconfirmed that they shall continue exchange of general and project-specific information and reference materials and mutual corporation in developing standardization experts. The China Association for Standardization shall continue to work as the secretariat <sup>[16]</sup>.” In South

**Table 1** : European universities with courses related to standardizations

Country	University	Aim (education/ research)	Type (humanities / sciences)
Germany	Technical University of Aachen, Computer Science Dept., Informatik IV	Research	Sciences
	Dresden University of Technology, Department of Economics	Partial education, research	Humanities
	University Erlangen-Nürnberg Faculty of Law and Technics	Research	Combination
	J.W. Goethe University Chair of Economics, esp. Information Systems	Special education, research	Humanities
	Universität der Bundeswehr Hamburg Department of Standardization and Technical Drawing	Special education, research	Sciences
	University of Hamburg, Institute of SocioEconomics (IAW)	Special education, research	Humanities
	Fraunhofer Institute, Systems and Innovation Research	Research	Humanities
Greece	Aristotel University of Thessaloniki, Union of Hellenic Scientists for Prototyping and Standardization	Partial education, research	Sciences
Lithuania	Kaunas University of Technology, Economics and Management Faculty	Partial education, research	Humanities
	Klaipeda University, Marine Technology Faculty	Partial education	Sciences
Malta	University of Malta, Faculty of Mechanical and Electrical Engineering	Partial education, research	Sciences
Sweden	Stockholm School of Economics, Center for Organisational Research (SCORE)	Research	Humanities
Netherlands	Delft University of Technology, Faculty of Technology, Policy and Management	Special education, research	MoT
	TNO Institute for Strategy, Technology and Policy Studies, Information and Communication Technology Policy	Research	Humanities
	Eindhoven University of Technology, Faculty of Technology Management	Special education, research	MoT
	Erasmus University of Rotterdam Management of Technology and Innovation	Special education, research	MoT
UK	University of Sussex, Science and Technology Policy Research	Research	MoT
	University of Edinburgh Research Centre for Social Sciences/Technology Studies Unit	Research	Humanities
	Queen Mary Intellectual Property Research Institute, Centre for Commercial Law Studies, Queen Mary, University of London	Partial education	Humanities
	University of Manchester, Manchester Business School	Partial education, research	Humanities

“Partial education” indicates that standards are taught as part of specialized education. “Special education” indicates that there is a course dedicated to standardization education. Source: Prepared by STFC, based on information available on the Web<sup>[13]</sup>

Korea, the Private Sector Standards Team of the Korean Standard Association is promoting standards-related education. For 2005, the team not only established standards-related courses at the 33 universities listed in Table 2, but also published a common text book entitled “Future Society and Standards” for use in the courses. Graduate courses are now being planned<sup>[17]</sup>. These activities in South Korea are drawing

the attention of European and North American countries<sup>[18]</sup>.

Furthermore, there is another international initiative called the Asia Link Project<sup>[19]</sup>, which intends to develop a curriculum for standardization education by 2006 through collaboration between universities in Europe (Helmut-Schmidt-University, University of the Federal Armed Forces - Hamburg, and Erasmus University

**Table 2** : South Korean universities offering standards-related education

University	Involvement (sciences/school-wide)
KOREA University	Sciences
Catholic university of DAEGU	Sciences
DAEBUL University	School-wide
PAICHAJ University	School-wide
SILLA University	School-wide
YONSEI University	Sciences
WONKWANG University	Sciences
CHUNG-ANG University	Sciences
HANSHIN University	Sciences
HANYANG University	Sciences
Catholic Sangji College	Sciences
KANGWON National University	Sciences
KUNKUK University	Sciences
Gyeongju University	School-wide
Kyung Hee University	School-wide
KWANGWOON University	Sciences
FAR EAST University	Sciences
Kumoh National Institute of Technology	Sciences
NAMSEOUL University	Sciences
Dongduk Women's University	School-wide
DONG-EUI University	School-wide
Seokyeong University	School-wide
SEOUL National University of Technology	Sciences
SEOUL Women's University	Sciences
Sungkyunkwan University	School-wide
SoonChunHyang University	Sciences
Ajou University	Sciences
Youngsan university	Sciences
Chonbuk National University	School-wide
JEONJU University	School-wide
Chungju National University	Sciences
Korea Maritime University	Sciences
HONGIK University	Sciences

Source: Reference<sup>[17]</sup>

Rotterdam), China (China JiLiang University), Indonesia (Institute of Technology Bandung), Sri Lanka (University of Moratuwa), and Vietnam (National Economics University) started in 2004. Now that the outline of the curriculum has been defined, the project is about to proceed to discussion of the teaching materials. With a goal of completion of the curriculum by 2006, various organizations are participating in this project, including EU standardization organizations (CEN, CENELEC, and ETSI), standardization officials of the participating countries, and the ISO Secretariat<sup>[20]</sup>.

### 3 Current Japanese efforts to develop human resources for standards

In Japan, there is also growing awareness of the significance of developing human resources in the field of standardization. For example, “Intellectual Property Strategic Program 2004”<sup>[21]</sup>, which was announced by the Intellectual Property Policy Headquarters in May 27, 2004, points out the need to develop human resources for standardization as follows.

In “Chapter 3 Exploitation”, “Section 2 Support for International Standardization Activities” states, “(1) Reinforcing Strategic International Standardization Activities

3) Creating a favorable environment for the development of human resources specializing in standardization

In FY 2004, the Government of Japan will continue to establish environments to promote the development of human resources specializing in standardization at universities and other educational institutions. In this regard, the GOJ will encourage universities in particular to take voluntary measures to provide educational programs regarding standardization in courses for the development of human resources specializing in standardization that will directly lead to business, existing courses for the development of intellectual property experts, and Management of Technology (MOT) courses.

(Council for Science and Technology Policy, Ministry of Public Management, Home Affairs,

Posts and Telecommunications, Ministry of Education, Culture, Sports, Science and Technology, Ministry of Economy, Trade and Industry, and other ministries and agencies concerned).”

Our problem in Japan is that such awareness has not directly led to a concrete human resource development program. For instance, no further discussion has been conducted on what the ministries and agencies concerned should actually do to achieve the above goal and how to evaluate the results. As in the activities under the above-mentioned trilateral memorandum, Japan’s initiatives lack concrete measures, compared with China and South Korea’s ongoing efforts, which are producing outcomes. In this regard, Japan’s efforts could be viewed as less substantial.

In fact, Japan does not even compile statistics on the current state of standards-related education at Japanese universities. For this reason, we collected relevant information on our own initiative, by conducting a questionnaire survey using the experts’ network of the Science and Technology Foresight Center, as well as the Internet and other resources. The results are shown in Table 3. Major findings are as follows: standards-related courses (1) are currently offered at Jissen Women’s University, Chiba University, Tokyo University of Agriculture and Technology, Toyo University, Nara Institute of Science and Technology, Kinki University, and Japan Advanced Institute of Science and Technology, (2) were formerly offered at Waseda University and Hiroshima University, and (3) will be offered at Ochanomizu University and Yamagata University. There are many other universities that teach industrial standardization issues as components of various courses whose focus is not standardization.

If the number of universities in Table 3 alone is taken into account, Japan is placed between the U.S. and Europe. In reality, however, Japan neither has a center for standardization like the U.S. nor provides widely recognized educational courses as in Europe. Some courses were even cancelled after a few years of teaching. Overall, Japanese activities for standardization education lack consistency and coordination.

**Table 3** : Standards-related education at Japanese universities

University	Status	Faculty or Course Name
Azabu University		School of Veterinary Medicine, College of Environmental Health
Osaka University		Common course, "Chemistry of new substances"
Ochanomizu University	planned	
Kanazawa Institute of Technology		Technological theory
Kwansei Gakuin University		Graduate School of Policy Studies "Technology transfer"
Kibi International University		Department of Intellectual Property Management, School of Policy Management,
Kinki University	ongoing	Department of Information and Systems Engineering, International standardization policy
Kyushu University		School of Agriculture, Soil and food analysis methods; Graduate School of Medical Sciences "Protection of intellectual property"
Kobe University		Courses related to marine pollution prevention under international treaties and to the ship officer's certificate system at the Faculty of Maritime Sciences
University of Shizuoka Graduate School		Business administration
Shizuoka University		Faculty of Information, Computer networks
Shizuoka Institute of Science and Technology		"Electronic Components Engineering"
Jissen Women's University	ongoing	Department of Food and Health Sciences, Faculty of Human Life Sciences, Japanese and international standards concerning food
Chiba University	ongoing	International exchange courses, International standards
Tokai University		School of Engineering, Patent strategy
University of Tokyo		Faculty of Engineering (safety assessment), Food science on "JAS" at the Faculty of Agriculture
Tokyo University of Marine Science and Technology		Department of Logistics and Information Engineering, Faculty of Marine Technology, "Intermodal transport," "Inventory management," "Logistics information systems design"; Department of Food Science and Technology, Faculty of Marine Science, JAS; under consideration in the "Food logistics safety control professionals' training course"
Tokyo Institute of Technology		Department of Advanced Applied Electronics, Science and technology studies; Department of Electrical/Electronic Engineering, Technology management studies
Tokyo University of Agriculture and Technology	ongoing	Graduate school, Master's course program, "Industrial technology standards," "Standardization strategy"
Tokyo University of Science		Master of Intellectual Property course, Graduate School of Management of Science and Technology
Toyo University	ongoing	Graduate School of Business Administration
Nagaoka University of Technology		Mechanical safety engineering
Nagoya Institute of Technology		'Nagare (Fluid-related)' field
Nagoya University		Graduate School of Environmental Studies
Nara Institute of Science and Technology	ongoing	Interdisciplinary studies
Nihon University		Biochemical resources studies
Hitotsubashi University		Graduate School of Commerce and Management, Faculty of Commerce and Management, Graduate School of Law
Hiroshima University	discontinued	
Japan Advanced Institute of Science and Technology	ongoing	Technological standardization
Waseda University	discontinued	Business administration, Competition strategy
Yamagata University	planned	
Yokohama National University		Division of Electrical and Computer Engineering, School of Engineering, "Electrical code and facilities management"

Blanks in the status column indicate that standardization issues are covered in lectures in the faculty or course listed.

Source: Prepared by STFC

## 4 Problems concerning the development of human resources specializing in standards

Five critical issues need to be discussed in relation to the development of human resources specializing in standards.

The first problem is a lack of awareness of a changing role of standardization. As described in "1. Introduction," this change is the reason that human resource development in the field of standardization is attracting attention. Public understanding is necessary for the changing role of standards, together with the factors behind such change: (1) economic globalization has expanded markets for products and services beyond our shores, raising the need to take standards into consideration even at the development stage of technologies; (2) standardization activities towards global market becomes an indispensable part of organizational comprehensive strategies for the future; and (3) in society, standards are used as soft law to complement the current legal system<sup>[22]</sup>.

The second issue is the kinds of capabilities that standardization experts should possess. For example, in the past, people involved in standardization of programming languages were specialists in compiler technology and were expected to review specifications of language standards in order to reflect them in the design of their companies' compilers. However, today's professionals in programming language standardization need to work from the early stage of the programming language design, to estimate the expected profits from potentially expanded markets as a result of standardization, and to manage the cost of standardization, taking into account of the expected applications and operating/development environments. They should also be able to identify organizations and companies that would be willing to offer cooperation in the standardization process, and they should know how to deal with related intellectual property. For management standards such as those involved in Corporate Social Responsibility (CSR), standardization experts

should have extensive knowledge in fields ranging from business strategy through finance to public relations. Even experts in technical standards should be capable of handling a fairly extensive range of issues, as shown in the programming language example. They are expected to be capable of not only discussing technical issues but also solving legal and administrative problems, and even conducting negotiations in a foreign language. Demand for human resources with outstanding capabilities in such diverse areas is probably not limited to standardization, but can exist in any field. One challenge is to determine which of these capabilities are fundamental to human resources specializing in standardization.

The third issue is related to career paths, which are inherent in human resource development. In Japan, there is a tendency for standardization personnel not to be assigned important roles in organizations, even in industries where standards are emphasized. This situation is not likely to improve in the near future because it is a result of companies' past and ongoing treatment of standardization personnel combined with these employees' past and current positioning. This concern essentially arises out of the first problem that refers to what roles organizations (companies and countries) should assign to standards and how seriously they should address the issue of treatment of standardization experts.

This brings us to the fourth problem: Japan's traditional lack of awareness of and support for activities for constructing large cross-organizational frameworks and rules for time-consuming strategic activities such as international standards<sup>[23]</sup>. This also suggests a lack of career path for human resources dedicated to such activities, as mentioned under the third problem above. There are extreme opinions that attribute all these shortcomings to Japanese characteristics, but such reasoning will never lead to solutions. Adopting and utilizing a long-term strategic viewpoint is just as crucial for standardization as it is for other fields.

The fifth issue is the approach to standards in individual organizations. One option is to simply adopt and conform to established standards, as most Japanese organizations have done



over the years. Those multinational Japanese companies that need to apply international standards can recruit standardization personnel from Europe or in North America, have no need to hire experts within Japan. Meanwhile, for companies operating only within Japan, there is no direct imperative to observe international standards and thus no need for human resources in this domain. In such circumstances, human resource development for international standards would not be required in the first place. Let us discuss this issue more specifically. In a case where a company is developing a highly original technology, it does not have to be concerned about whether the technology will be accepted by others (although the company must certainly make the technology widely acceptable for profits). By contrast, standards are not worth developing unless they are accepted and applied by majority. This suggests that standards development involves different types of difficulties from those faced in developing original technologies. It also implies that prominent figures in standards development are rare, because standards are formulated by teams rather than by individuals. The cost of developing human resources specializing in standards varies widely, depending on whether the personnel are trained to become leaders or followers, depending on the organization's approach to international standards.

Solutions to the above five problems differ from country to country. For example, the third (career path) problem is very difficult to solve for Japan because it relates to Japanese-style organization and human resource management. On the other hand, in Western countries, where professionals exist in diverse fields, standards specialists and consultants are readily accepted. Human resource development is, ultimately, a long-term project for any country, there is no point in searching for a quick remedy. Given today's rapidly changing circumstances, it would be waste of time to try and build a quick consensus on the very best way to lay the cornerstone of a nation for next hundred years. One possible and realistic solution is to have different people make different efforts to develop next-generation human resources based on their own particular ideas. This report

proposes some possible actions that Japan can take to support human resource development in the field of standards. The next chapter focuses on educational curricula, development of which is already being discussed in China and other countries that aim to actively develop standards specialists.

## 5 Discussion on desirable education for different groups of people

### 5-1 *The need of education tailored to different groups of people*

Human resource education on standards targets several different groups of people. Besides those directly involved in standards development, it needs to reach users of standards (including the general public), government officials and academic experts who are concerned with the maintenance and establishment of standards, and corporate strategy makers who use standardization activities for business administration. To effectively educate all these groups, a program would need to address a wide range of issues: technologies related to the creation and distribution of documented standards, technologies related to the standards development process (e.g. how to organize conferences), research and development in diverse technological fields, the handling of intellectual property, related laws and systems, and even the treatment of standards in business administration. In reality, however, educational programs should be divided according to the nature of each group. One approach to grouping is simply to classify target personnel into either management or technology, in the same way as university student bodies are divided between humanities and science majors. However, this report adopts the following classification: (1) general users, (2) those who actually work with standards, and (3) those who strategically address standards. There are three reasons for this proposed classification. First, considering that Japan particularly lacks human resources to deal with standards-related strategy, as compared with the situations in European, North American, and other Asian countries, education

of such personnel should be distinguished from that of other groups. Second, the traditional division between the humanities and sciences is not effective for these kinds of strategic issues. Third, as described earlier, Japan's traditional training programs, which use OJT to educate standards-related personnel, are limited in their ability to address today's needs.

### 5-2 General education

General education is essential for laying the foundations in any field. The primary target of general education on standards is ordinary people who use standards, but it also includes young people who will be concerned with standards in the future.

The only country that is active in addressing general education on standards is South Korea, which plans to introduce such a course into high school education from 2006. However, many other countries are expected to follow suit in due course. The goal of general education should not be limited to teaching common knowledge of standards, but should also extend to enhancing the basic understanding that standards are intellectual assets of human beings, and that both efforts are necessary to revise existing standards and to establish new standards.

### 5-3 Practical education on standards

Practical education on standards aims to develop expertise in conducting standards-related tasks in workplaces, e.g. establishing standards, documenting them, and putting them into practice. As already discussed, such education has traditionally been provided by companies through OJT. However, most of today's companies can no longer afford standards-related OJT. Moreover, in order to adapt to a business environment shaped by intensifying global competition, professionally educated human resources are essential to effective performance of standards-related tasks.

Those who have received practical education on standards can mainly contribute to areas such as R&D and product development. Some may even find roles in both practical and strategic activities, since some of the practical tasks are relevant to standards-related strategy.

The core of practical expertise is international negotiation skills, which translate into how strictly one adheres to systems and procedures and how strictly one can induce others to adhere to them. Basic negotiation skills consist of:

- Logical thinking and presentation capability
- Ability to handle formalities in negotiations
- Technical English skills and English communication skills for conferences and negotiations
- Skills necessary for persuading concerned parties of the merits of one's argument

For establishment of actual standards, the following elements are needed:

- Understanding of management practices specific to standardization organizations
- Understanding of sector-specific standardization organizations
- Ability to build competitive and cooperative relationships with competitors and related companies through the standard development process
- In Japan, understanding of the terminology and procedures involved in formulating JIS standards, and knowledge of tools used to develop JIS standards.

### 5-4 Education for those who strategically address standards

The target of this education can be divided into two types: those who have experience in standards-related activities, and those who have experience in strategy-related jobs. (Educating those who have never been engaged in either area would be impractical.) Once educated to strategically address standards, they can contribute, on a broader basis, to national and regional standards-related strategy and measures, industries' and trade organizations' standards-related strategies, and businesses administration in which standards-oriented strategy is needed. On the more practical side in private sectors, they can assume roles in formulating standards-related strategy within the framework of intellectual property strategy, or as part of product development.

Besides the general elements of education, such as establishing goals, developing implementation measures and evaluating the results, strategic education on standards should include the following: understanding of both the current situation and future trends in standardization; materials and methodologies for formulating remedies with which to achieve a desirable state, in light of both the current situation and future trends; and skill acquisition for using such materials and methodologies. Except for certain elements, such as the acquisition of technical skills and conformity assessment, the education discussed here involves highly social activities, which make experimentation impossible during the learning process. Case studies on strategies will play a critical role in this process.

Education on the current state and future trends should cover standards development organizations, national strategies related to standards, standards acting as legislation (including soft law and hard law), standards in global markets, standards' relationship with intellectual property strategy and product development strategy, the cost and benefits of establishing standards, and the risks and benefits of independent (internal) standards.

Whatever the target group, the most important consideration for Japan in offering education on standards-related strategy is to strengthen the fundamental awareness that standards are something that should be proactively developed and revised, rather than something that is provided by others. Without this perception, we will be confined to merely deciding which standards to choose and when to adopt them.

## 6 Conclusion

Strategy on standards is as essential to science and technology promotion as strategy on patents, from the viewpoint of managing intellectual assets from the moment of genesis in scientific and technological activities. Today, standards have taken on much greater importance in relation to change not only in the globalization-driven market environment, but also in legal systems. Based on this awareness, this report has described the current state of

human resource education on international standards around the world and in Japan, and has highlighted problems and issues. Moreover, the report has discussed what kind of human resource education is desirable for three different target groups: the general public, those who actually work with standards, and those who strategically address standards.

In addition to standards themselves, the issues relating to human resources involved in standards need to be addressed strategically. History suggests that traditional standards-related activities in Japan have focused mainly on individual issues, causing us to lag behind even other Asian countries when it comes to making strategic efforts. Newly industrialized Asian countries, typified by South Korea, are focusing on the strategic value of standards and reinforcing government-led human resource development. Among Western countries, the U.S. has been slow to develop standards specialists at universities and, as in Japan, corporate human resource development through OJT is waning there. However, these drawbacks have been offset by standardization efforts led by active consortiums, or forums and nonprofit organizations, and a proliferation of independent consultants.

In Japan, human resource development for standards is promoted under programs such as Intellectual Property Strategic Program 2004, and courses on standards are offered at universities, as shown in Table 3. However, there are still no clear answers to the questions of who should spearhead efforts for human resource education at a national level and what kinds of activities are ongoing, and the problem of standards-related course content varying widely between universities. In short, in Japan, consciousness of problems concerning standards has not led to implementation of substantial human resource development programs. As a result, Japan continues to face such conventional problems as shortages of experts in standards-related strategy and failure to train and develop successors to experienced standards personnel.

An effective solution to these problems would be the establishment of a concrete, visible framework such as a "center for the development of standards experts." A name like "standards

strategy center” may be more appropriate if such an institute were to be geared to the development of professionals in standards-related strategy, which Japan will need toward the future. This institute could undertake such functions as:

- Designing educational programs for strategic human resource development
- Collecting information on what kinds of education are offered to which groups of people
- Constructing a database of practices concerning standards
- Developing a career path for standards experts
- Actively disseminating the above information.

To overcome the above challenges and promote active utilization of human resources, the institute should collaborate with industry and other related sectors. It should also facilitate active utilization of properly trained and developed human resources.

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#### Glossary

##### \*1 international standard(s)

This term is usually translated into Japanese as “kokusai hyojun” or sometimes “kokusai kikaku.” International standards are those set by international standards development organizations, typically ISO, IEC, and ITU. While ITU is a subordinate body of the United Nations, ISO and IEC are nongovernmental, nonprofit organizations. Standards development organizations, with their members representing countries and regions around the world and procedures to build international consensus, develop de jure standards. De facto standards or consortium standards (also known as forum standards) are those that have been developed without such formal international procedures and therefore are distinguished from de jure standards, even though they may be widely adopted internationally. Consortium standards sometimes appear into de jure standards as a result of specific (mostly short-cut or fast track) procedures established by international standards development organizations.

##### \*2 standard

This term is translated as “hyojun” in Japanese, when “standard” specifically refers to a set of criteria defined by a country or organization rather than expressing its general meaning of model, measure, or norm. “Standard” is sometimes translated as “kikaku” (e.g. Heibonsha’s World Encyclopedia). Some dictionaries list “hyojun kikaku” as the translation (e.g. Progressive English-Japanese Dictionary). In general, standards are set by consensus of the parties concerned. The standards development process starts with selection of those parties and includes a procedure for building a consensus among them. Some standards are widely adopted without such procedures; these are called “de facto standards.”

##### \*3 soft law

In the absence of a formal Japanese equivalent, this English term is used to describe a set of rules (code) that is not

legally enforced by the national government but is observed on a voluntary basis. In fact, companies and individuals are expected to follow these rules, and compliance with them can bring benefits while noncompliance can result in economic disadvantages and social criticism. Examples of soft law are standards, codes of conduct, and self-imposed controls. They are called “soft laws” as a contrast to “hard laws,” which are legally binding rules whose violation can result in punishment or administrative disposition<sup>[22]</sup>. Soft laws are also referred to as “voluntary codes.”<sup>[24]</sup> Note that some hard laws, including the Road Trucking Vehicle Law, Building Standard Law, Electrical Appliance and Material Safety Law, and Food Sanitation Law, adopt standards, suggesting that standards are not always merely soft laws.

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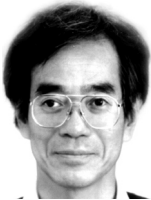
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