

THE ORGANIZATION OF INFORMATION STANDARDS IN THE CHINESE CONSTRUCTION INDUSTRY

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SUMMARY: *Like many other countries that had already experienced before, the Chinese construction industry recently faced a challenge to develop an effective and efficient organizing system for its large number of information standards. Such an organizing system, including standard categorization and classification, as well as rules and procedures of managing a standardization project and revising existing standards, serves as a blueprint for existing and future standardization efforts. Addressing the characteristics of the Chinese construction industry while maintaining compatibility with existing well-accepted international standards, the organizing system needs to satisfy requirements that can make it unique, comprehensive, systematic and extensible. Although the subject, as well as its methodology, is not new and may seem less innovative, the introduction of the organising system itself, together with the discussions on issues related to the development of the system, provides valuable information to researchers and practitioners because of the unique social, technical and political context reflected through the organizing system. To this end, the major objectives of this paper are to provide a systematic introduction of the organizing system and share major issues related to the development and implementation of the system, so that readers may have better understanding towards the standardization efforts in the Chinese construction industry, as well as the social, technical and political implications associated with the efforts.*

KEYWORDS: *China, construction industry, informatization, information technology, standards.*

1. THE IMPACT OF INFORMATIZATION ON THE CHINESE CONSTRUCTION INDUSTRY

In this section, authors will provide an overview about an effort that the Chinese government has launched to transform the social and economic structure of China, initiatives in the Chinese construction industry triggered by such transformation, and a need for an organizing system for information standards in the Chinese construction industry to better deal with such transformation.

1.1 Informatization in China

The concept of “informatization” was explored by many researchers around world in the last decades (e.g. Jung et al. 2004, Wang and Guo 2005). The concept, first introduced by Japanese researchers in the late 1960’s, has impacted the thinking of many Japanese policy makers for decades as they realized the imminent arrival of an information-based society and the need for transforming labour-based mass production to knowledge-based economy for Japan in order to improve its competitiveness. In essence, informatization refers to “process primarily by which information technologies, such as the world-wide web and other communication technologies, have transformed economic and social relations to such an extent that cultural and economic barriers are minimized.” (Kluser 2000)

The concept has a significant impact on the thinking of the Chinese researchers and policies makers recently (e.g., Jiang et al. 2005). Realizing that information technology is stimulating an industrial revolution worldwide and becomes a pivot economic engine, the Chinese government, including the Ministry of Construction, has strategically adjusted social and economic development goals to emphasize the importance of information

technology when developing the Tenth Five-Year Plan (from 2001 to 2005). Under such a plan, informatization is planned and implemented by the Chinese central government, focusing on information resources, national information infrastructure, the application of information technology, information technology and intellectual properties, the training and education related to information technology, and relevant policies, regulations and standards.

With such a focus, three major tasks are identified:

- Promoting the application of information technology,
- Enhancing national information infrastructure and
- Expediting the development of electronic, communication and information technology industry in China.

1.2 The Initiatives in the Chinese Construction Industry

In the Chinese construction industry, informatization starts with the application of information technology. In 1996, the Ministry of Construction published a white paper on construction technology policies for years from 1996 to 2010. One of the areas promoted by that white paper is the application of computer technology in construction. However, the concept of informatization was not introduced at that time. In 2003, the Ministry of Construction published another similar document, which specifically discussed informatization in construction (MOC 2003).

In order to promote informatization in the Chinese construction industry, the Ministry of Construction has developed a strategic plan (MOC 2003). The objectives of the strategic plan are,

- To develop information systems that address requirements and conditions of the Chinese construction industry,
- To realize nationwide sharing of construction information in order to support decision-making, improve project management, and provide better government services to the public at different administration levels,
- To promote research in the areas of IT (Information Technology) applications to construction and
- To incubate and develop construction technology market.

In China, the scope of the construction industry, much larger than that in Western countries, includes urban planning, urban development, building and construction, and housing and real estate. Thus, in this paper, the concept of construction information actually includes information in all of the abovementioned industry sectors.

1.3 The Need for an Organizing System of Information Standards

To realize the objectives, the Ministry of Construction has developed top-down execution plans to implement the strategy of promoting informatization in the Chinese construction industry. One of the major issues is to develop standards related to data, technology and other management issue in the construction industry (Shang et al. 2004). Consequently, due to the complexity of the Chinese construction industry, the proliferation of information standards naturally calls for an effective organizing system. The major components of the organizing system include categorization, classification, and rules and procedures of managing standardization projects and revising existing standards, which are the focus of this paper.

2. THE CATEGORIZATION OF INFORMATION STANDARDS

The design of the categorization follows two major principles, i.e., compliance and compatibility with other national and international standards, and emphasis of characteristics and requirements of the Chinese construction industry.

At the international level, standard development methodology and the management of international standardization bodies such as ISO (International Standard Organization) and IEC (International Electrotechnical Commission) provide exemplary cases and experience that have been referenced. While developing the organizing system for information standards in the Chinese construction industry, researchers and developers have recognized that such standards have some distinctive characteristics.

At the national level, information standards developed for the Chinese construction industry are designed in such a way that they are also in full compliance with the requirements of other related national standards.

In the following sections, the authors discuss the categorization and the coding schemes that are applied to each individual standard, the classifications used by the Chinese government to organize various standards in the construction industry, and the structure of the standard classification tables.

2.1 Categorization of Standards

Each individual standard is categorized according to its application domain, legal implications, characteristics or subject and functionality.

2.1.1 Categorization based on Application Domains

According to existing laws in China, standards are categorized into four groups based on their application domains (<http://www.sac.gov.cn/english/cnmng/index2.asp>), i.e., national standards, professional standards, local standards and enterprise standards. The terminology is coined and used by the Standardization Administration Committee (SAC) under the State Council of the People's Republic of China.

- National standards – standards that are developed by the Standardization Administration Committee (SAC) to address nationwide standardization needs,
- Professional standards – standards that are not covered by the national standards but are required by a particular industry, business or technology sector. The standards are developed and administrated by the corresponding administrative ministry in China. The Standardization Administration Committee (SAC) keeps records of such standards for reference,
- Local standards – standards that are developed by local government, such as state/province or city government, but not covered by the national or the professional standards and
- Enterprise standards – standards that are developed by an organization such as a company to cover standardization requirements that are not addressed by the national, professional or local standards.

2.1.2 Categorization based on Legal Implications

According to different levels of legal implications that standards may possess, standards are categorized as mandatory standards, voluntary standards and technical guidelines.

Mandatory standards are those that specify criteria and regulations that any organization or individual nationwide must abide to while conducting business, production, service or management activities in order to protect public health and private or public properties. In China, there are corresponding laws to enforce the mandatory standards. In addition, mandatory standards are an important part of national technical regulations that set standards for products, processing or production methods and terminology, trademarks, packaging and symbols. Given the significance of world trade to China's economy, such technical regulations are critical to comply with WTO (World Trade Organization) regulations for goods and products produced in China.

Voluntary standards are guidelines setting criteria for products, processing or production methods and terminology, trademarks, packaging and symbols. As the name indicates, voluntary standards are not mandatory. They are up for individuals and companies to determine the adoption of such standards. The Chinese laws encourage individuals and companies to follow such standards.

Technical guidelines provide technical assistance for standardization efforts involving technology that is rapidly changing. The SAC at the national level develops such guidelines.

2.1.3 Categorization based on Characteristics

Standards can also be categorized based on their characteristics, such as technical standards, management standards and work standards.

Technical standards specify technical criteria. Management standards, aiming at coordinate relationships among various entities or organizations at a macro level in order to improve effectiveness and efficiency for the entire society or an industry, set criteria in terms of defining and managing a social and economic structure, as well as its corresponding distribution of authorities and responsibilities, interrelated processes and resource allocation. Work standards, focusing on evaluating the performance of an organization or a company at a micro level, specify issues that need to be standardized for production and management processes.

2.1.4 Categorization based on Subject and Functionality

In addition, a standard can be categorized based on the subject and the functionality of the standard, such as:

- Basic standards – providing basic criteria or definitions for other standards, such as terminology, symbols, codes, logos, unit of measure and diagrams,
- Product standards – providing standards specifying product characteristics, such as product categories, technical requirements, testing methods, packaging, transportation and storage requirements,
- Method standards – providing standards specifying methods such as sampling, surveying, testing, data collecting and data analysing,
- Safety standards – providing standards specifying safety requirements for human beings and private or public properties,
- Health protection standards – providing standards specifying the protection of health for human beings, including food, drug and other health related standards and
- Environment protection standards – providing standards specifying the protection of environment.

2.2 Coding System of Standards

Besides categorization, a standard uses a unique code for identification. The Standardization Administration Committee of the State Council adopts a standard format for coding a standard. A code contains three parts, an identification number, a sequence number and a number representing the year that a standard is adopted (Table 1) (Lai and Wang 2003).

TABLE 1: Coding Scheme of a Standard

		Identification No.	Sequence No.	Year of Adoption
National Standards	Mandatory	GB	Max Five Alphanumeric	Four Digits
	Voluntary	GB/T	Max Five Alphanumeric	Four Digits
	Guideline	GB/Z	Max Five Alphanumeric	Four Digits
Professional Standards	Mandatory	Two Digits	Max Five Alphanumeric	Four Digits
	Voluntary	Two Digits / T	Max Five Alphanumeric	Four Digits
Local Standards	Mandatory	DB plus Six Digits	Max Five Alphanumeric	Four Digits
	Voluntary	DB plus Six Digits /T	Max Five Alphanumeric	Four Digits
Enterprise Standards		Q/ plus Organization Code	Max Five Alphanumeric	Four Digits

The abbreviations, “GB”, “DB” and “Q”, stand for national standards, local standards and enterprise standards respectively. In addition, “T” refers to voluntary standards and “Z” refers to technical guidelines. The SAC also sets specific format for identification numbers, sequence numbers and years of adoption.

Meanwhile, the SAC provides standard codes for recognized business, industry or technology sectors to be used for professional standards. Table 2 (Lai and Wang 2003) contains a portion of such professions. Currently, there are in total 57 sectors recognized by SAC. The sequence numbers and the codes are assigned and administrated by SAC. The codes in Table 2 are used to identify professional standards. For example, the sequence number and the code for the Chinese construction industry are 41 and JG respectively.

The SAC also provides standard codes for provinces and cities that are used in local standards. For example, Beijing is 110000, Shanghai is 310000 and Taiwan is 710000.

In addition, if an organization would like to file an application, the organization needs to apply for an identification code that is administrated by the central or the local government. The enterprise standards only apply to the enterprise or the organization that files the application to establish such standards.

Therefore, it is clear that the standardization effort in the construction industry is just a part of a nationwide ambitious, systematic and extremely complicated endeavour to develop a national standard system that covers many social and economic aspects of China.

TABLE 2: Sample Codes for Recognized Professions in China

Sequence No.	Name of the Profession	Code
1	Education	JY
2	Healthcare	YY
...		
13	<i>Construction Materials</i>	JC
...		
25	<i>Transportation</i>	JT
...		
40	<i>Urban Development</i>	CJ
41	<i>Construction</i>	JG
...		

2.3 Classifications of Standards

In this section, classification schemes are discussed, including a typical classification, as well as classifications based on industry sectors and IT (Information Technology) applications.

2.3.1 A Typical Classification

A typical classification of standards is shown in Fig. 1. With such a classification system, standards are grouped into three layers, i.e., basic standards, generic standards and specialized standards. Basic standards are those defining basic elements of standards, i.e., providing basic criteria or definitions for other standards, such as terminology, symbols, codes, logos, unit of measure and diagrams. Generic standards specify technical criteria that are applicable to all sectors of the construction industry. Specialized standards reflect specific technical requirements of a particular sector in the construction industry.

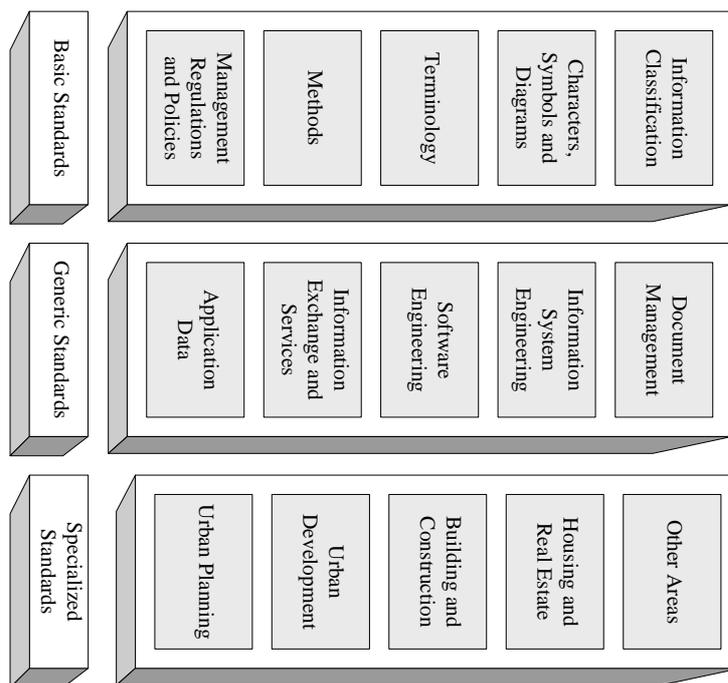


FIG. 1: A Typical Classification of Standards

Within each layer, standards are further classified. For example, the basic standards cover Management Regulations and Policies, Methods, Terminology, Characters, Symbols and Diagrams, and Information Classification and Coding. Tables 3 to 5, standard classification tables, show some sample standards classified under each layer.

The layered structure allows standards at higher levels make references to those a lower level, with basic standards at the lowest level and specialized standards at the highest level. For example, a generic standard or a

specialized standard may make references to basic standards. A basic standard cannot however make references to higher-level standards, such as a generic standard or a specialized standard.

2.3.2 Classification based on Industry Sectors

In China, the construction industry is divided into many sectors, such as urban planning, urban development, building and construction, and housing and real estate. Although commonality exists among those industry sectors in terms of utilizing information technology to support various applications, information requirements, information flow models and the application of information technology vary from sector to sector. Therefore, according to the commonality and the differences among those industry sectors, standards can be grouped into three layers (Fig. 2). It has to be noted that the standards discussed here are not different standards from those discussed in the typical classification. Here, a classification is simply a different way to group the same set of standards.

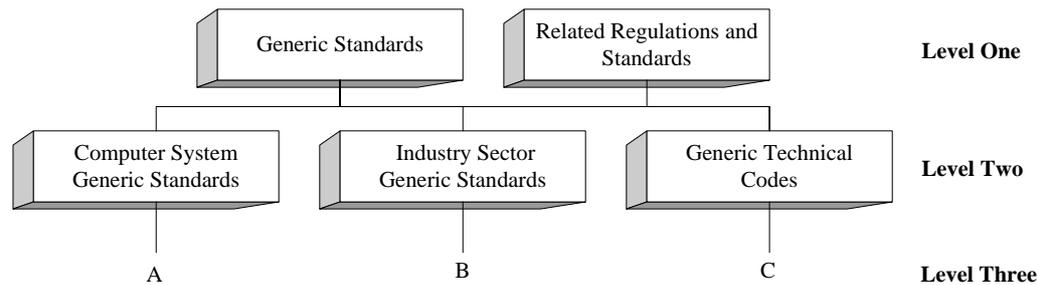


FIG. 2: A Classification based on Industry Sectors

The classification can be divided into three layers (Figure 2). In addition, the Industry Sector Generic Standards contains, similar to those in the typical classification:

- Urban Planning Information Standards (level three),
- Urban Development information Standards (level three),
- Building and Construction Information Standards (level three),
- Housing and Real Estate Information Standards (level three) and
- Other Information Standards (level three).

The Computer System Standards include:

- Administration Methods (level three),
- Information Classification and Coding Standards (level three),
- Spatial Data Standards (level three),
- Property Data Standards (level three),
- Database Standards (level three),
- Software Engineering and System Design Standards (level three) and
- System Development Documentation Standards (level three).

The Generic Technical Codes include:

- Evaluation and Testing Standards for Digital City Software (level three) and
- Standards for Database Application Design (level three).

2.3.3 Classification based on Information Technology

Another classification scheme for standards in the Chinese construction industry is based on information technology (Fig. 3). Among the standards, only those in Information Technology Applications require significant effort from the construction industry. Other standards are developed and administrated by other industries, or the SAC, which can be referenced by the standards in the construction industry.

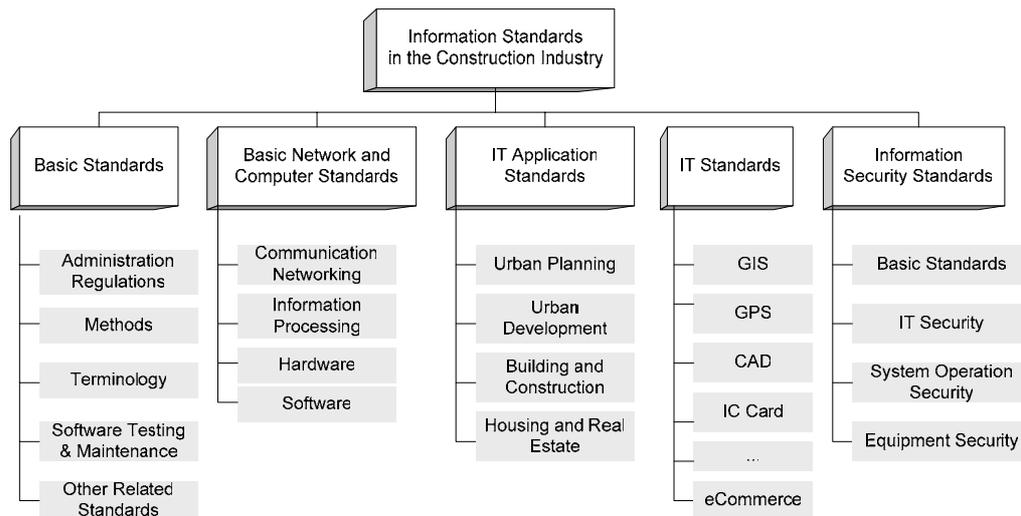


FIG. 3: A Classification based on IT

2.3.4 Standard Classification Tables

TABLE 3: Basic Standards

Code	Title of a Standard	Existing Standards	Notes
101	Management Regulations and Policies		
101.1	Guidelines for a Standardization Project, Basic Rules	GB/T 1.1 - 1993	
101.2	Guidelines for a Standardization Project, Publication Rules	GB/T 1.2 - 1996	
...	...		
101.9	Rules for Construction Information Technology Application Management		Professional Standards
102	Methods		
102.1	General Principles and Methods for Defining Terminology	GB 10112 - 1988	
102.2	General Principles and Models for a Terminology Database	GB/T 13725 - 1992	
...	...		
102.5	Document Format Classification and Coding Methodology	GB/T 11457 - 1989	
103	Terminology		
103.1	Basic Terminology of Standardization, Part I	GB/T 3935.1 - 1996	
103.2	Generic Terminology for Classification Codes	GB 10113-1988	
...	...		
103.9	Information Terminology in Construction		Professional Standard
104	Symbols, Diagrams and Characters		
104.1	Symbols and Conventions for Data Flow Diagrams, Process Diagrams, System Diagrams, Network Diagrams and System Resource Diagrams	GB 1526 - 1989	
104.2	Image and Character Point Matrix for Data Exchange	GB 3909 - 1983	
...	...		
104.7	Standard Characters, Diagrams and Symbols for Construction Information Systems		Professional Standards
104.8	Standard Electronic Data Files for the Construction Industry		Professional Standards
105	Information Classification and Coding		
105.1	Application Data Classification and Coding in Construction		Professional Standards
105.2	Classification and Coding of Engineering Economic Criteria in Construction		Professional Standards

The standard classification tables are another way to organize standards, although they don't intuitively reflect the hierarchical structure. For example, Tables 3 to 4 include standards corresponding to those based on the typical classification. Those tables use codes to indicate grouping and the hierarchical structure. The tables also indicate the existence and the category of a standard. For example, in Table 3 standard "Guidelines for a Standardization Project, Basic Rules" is an existing standard, "GB/T 1.1 – 1993", which indicates that the standard is referenced and not developed by the construction industry. In addition, the table shows that the standard, "Rules for Construction Information Technology Management", is a professional standard, in which case it is a standard developed and administrated by the Ministry of Construction. Therefore, the tables are complementary to diagram-based classification schemes as discussed above.

TABLE 4: Generic Standards

Code	Title of a Standard	Existing Standards	Notes
201	Application Data		
201.1	Database Language SQL	GB/T 12991 – 1991	
...			
201.3	Guideline to Database Management Systems		National Standard
...			
201.22	Information Classification and Coding for Urban Geographic Information Systems		Professional Standard
201.23	Application Data Classification and Coding in Construction		Professional Standard
201.24	Data Quality and Quality Control in Construction		Professional Standard
201.25	Standard Data Format in Construction		Professional Standard
...			
202	Information Exchange and Services		
202.1	Copy of EDI International Agreement for Commercial Purposes	GB/T 17629 – 1988	
202.2	Data Communication		National Standard
...			
202.8	Information Processing System – Open System Connection, Reference Models	GB 9387 – 1988	
...			
202.15	Standard Electronic Data Exchange in Construction		Professional Standard
...			
203	Software Engineering		
203.1	Information Processing – Guidelines of Code Development for Application Software Systems	SJ/Z 9060 – 1989	
...			
203.8	Information Processing – Software User Documentation	ISO/IEC 15910:1999	
...			
203.30	Software Engineering Technical Standards in Construction	JGJ/T 90 – 1992	
203.31	Standard Software Testing and Evaluation in Construction		Professional Standard
204	Information System Engineering Technical Standards		
...			
204.5	Software Development in Construction		Professional Standard
204.6	System Security in Construction		Professional Standard
...			
204.9	Information System Documentation in Construction		Professional Standard

...			
204.15	e-Business in Construction		Professional Standard
205	Document Management Information Systems		
205.1	Technical Standards of Document Management Information Systems in Construction		Professional Standard

There are tables for specialized standards organized according to the classification shown in Fig. 1. This paper will not get into details.

2.3.5 The Relationships among the Classifications

The three classification methods are essentially different perspectives to the same set of standards. The typical classification groups standards according to two dimensions. Vertically as shown in Fig. 1, standards are organized according to their generality and specificity. From basic standards to generic standards to specialized standards, the content of a standard becomes more and more specific to a particular subject in the construction industry. Horizontally, standards are grouped according to data, data/information exchange, software engineering, document management and so on to ensure the successful application of information technology. Standards for data interoperability can fit well in the classification of data/information exchange.

The classification based on information technology organizes standards according to subject of information standards, including, information, information technology, information technology application and management. Such a classification has a similar focus as the horizontal dimension of the typical classification.

The classification based on industry sectors has a stronger focus on the differences, as well as commonality, of the various sectors in the construction industry, similar to the vertical dimension of the typical classification.

The three classifications are very much related. The typical classification represents a logical combination of the focuses of the other two classifications.

In addition, the classification and the categorization are complementary. For example, the standard, e-Business in Construction (204.15) is classified as one of the Information System Engineering Technical Standards (Table 4) and categorized as a professional standard (Table 4). Further categorization such as legal implications may also be applied. In the same Table 4, the standard, Database Language SQL classified as 201.1, is categorized as “GB/T 12991-1991”, which suggests that the adoption of this national standard in the construction industry is optional.

The categorization can also make the classification extensible in that it allows incorporating or reusing existing standards. For example, Table 4 shows a standard numbered 203.8, “Information Processing – Software User Documentation”, which is actually an ISO/IEC (International Electrotechnical Commission) standard.

2.4 A Comparison with the Categorization and the Classification of Other Standards

Based on the previous discussion, it is interesting to notice that there are some unique features in the design of the organizing system in China if compared with some known counterparts such as ISO, IEEE, ANSI and ASTM standards. In the following, the paper will compare the categorization, classification and legal implications between the Chinese system and its counterparts.

Compared with the ISO, IEEE, ANSI and ASTM standards, the concept of categorization developed in China is very unique. The categorization, capable of representing standards in different views, provides an additional level of a framework for organizing standards to classifications. A standard may be classified as an Urban Planning Information Standard, but it can be further categorized as mandatory or optional. In order to be consistent and comprehensive, it is necessary for the Chinese government to develop and maintain such a complex, yet unique, comprehensive, systematic and extensible framework to complement the classifications.

With such a framework, standards in the construction industry, as well as other industries, can be very well categorized by using its coding system, which provides a comprehensive and systematic view of the standards developed in China and each industry. For example, Table 2 shows that standards related to construction materials have a sequence number of 13; while other industry sectors also have their own numbers.

There are also different categorizations for different purposes. For example, the categorization based application domain, actually represented by a top-down complementary structure, form an organization of different levels of standards, i.e., national, professional, local and enterprise standards and lower-level standards, e.g., the professional standards, can cover subjects that are not included in higher level standards, e.g., the national standards. Therefore, the top-down complementary structure is unique in that it provides flexibility that allows compatible extensions, such as allowing different states, cities and even companies to plug in necessary standards with different levels of legal implications.

Other international standards do not have an equivalent layer in their organizing system. For example, although ISO has a broad coverage, the categorization of the ISO standards is different from that of the Chinese counterpart in that it uses the International Classification of Standards (ICS) (<http://www.iso.org/>), which does not have a sense of hierarchy as the Chinese categorization system has. Similarly, the IEEE standards (<http://standards.ieee.org/>), the ANSI standards (<http://www.ansi.org/>) and the ASTM standards (<http://www.astm.org/>) do not have such a structure either. The structure is necessary for the Chinese standardization effort because of its scope and complexity, but may not be required by other standards.

It is also interesting to note that the standards in China may be classified as mandatory, which means once the standards are developed and approved, they become law. On the other hand, the adoption of standards developed by ISO, IEEE, ANSI and ASTM are voluntary, although some governments may adopt them into legislation and enforce them.

While the categorization provides an overall organizing system for all standards developed in China, the classification methods discussed above has a focus on the construction industry. Although all other standard organizing systems have classifications, the Chinese classification system provides three different views to the same set of standards, i.e., the typical classification, the classification based on industry sectors and the classification based on information technology, whereas other standards, i.e., ISO, IEEE, ANSI and ASTM, usually use one classification system. For example, ISO use the ICS (International Classification of Standards) classification, which covers a wide range of subjects, not just those related to the construction industry. It is yet to determine the benefits of having multiple views of classifications.

3. MANAGING A STANDARDIZATION EFFORT

In this section, the authors discuss three topics related to managing a standardization effort, i.e., planning for a standardization project, procedures for developing a standardization project and revising existing standards.

3.1 Planning for a Standardization Project

Inevitably standards in the construction industry cover a broad area; therefore to have a successful standardization project planning is critical. During planning, issues such as the scope of a standard, its administrative and legal implications, its applicability and practicability, and its relationship with other relevant laws, regulations and policies, must be considered and resolved. In addition, a standardization project not only takes time and resources, but also affects relevant existing standards in terms of coordination.

Some guidelines that are applied to the development of standards for the Chinese construction industry include,

- In alignment with the overall goals and objectives, regulations and policies of central and local government,
- Satisfying the needs for informatization and technology advancement in construction,
- In compliance with the overall design and rules of standard categorization of the construction industry, and
- Prioritising and balancing the needs for developing new standards according to requirements from industry practice.

The planning process of a standard development project is as following (Fig. 4).

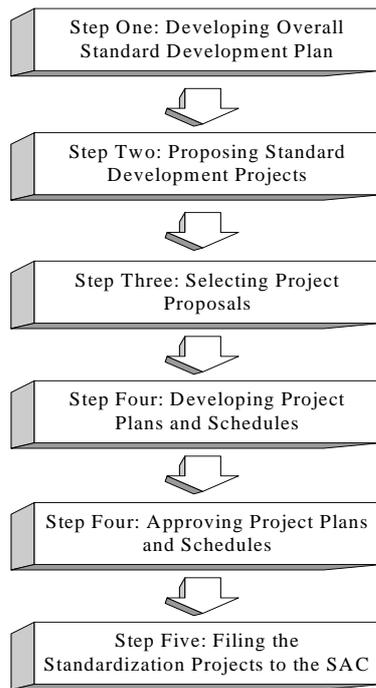


FIG. 4: A Planning Process for Standard Development

Fig.4 shows a planning process for standard development. In general there are five steps.

1. Step One. In the first step, the administrative department in the central government, a department within the Ministry of Construction, develops an overall task plan that identifies the needs for standard development for the Chinese construction industry. The plan includes prioritized areas where standards are required, as well as principles and rules for developing standards in those areas.
2. Step Two. According to the task plan, any governmental or non-governmental organization, or an individual, may develop and submit a proposal to the standard administration departments at different administration levels, such as the Ministry of Construction or local departments.
3. Step Three. The standard administration departments select proposals based on a set of criteria and priorities. Different categories of standards have different criteria. For example, national level standards have the criteria including:
 - The proposals must demonstrate evidence of preliminary work,
 - The proposals must demonstrate having practical needs,
 - Relevant technology and research results that are referenced by or included in the proposals must be evaluated and proven to be applicable,
 - There should be no contradictions with existing standards, and
 - The personnel resource for developing standards must be allocated and available.

In addition, the Chinese government has specific requirements on the qualifications of investigators who assume the responsibility for developing standards. There are also specific requirements regarding the preliminary work.

4. Step Four. The proposers of the selected proposals develop and submit project plans and schedules.
5. Step Five. Once the administrative departments in construction approve the project plans and schedules, the standardization projects can be formally started.
6. Step Six. For professional standards, details of the projects need to be sent to the relevant offices in the SAC.

3.2 Procedures for Developing a Standard

Once a standard development project is approved, the development follows a certain procedure. In general, there are four steps (Fig.5).

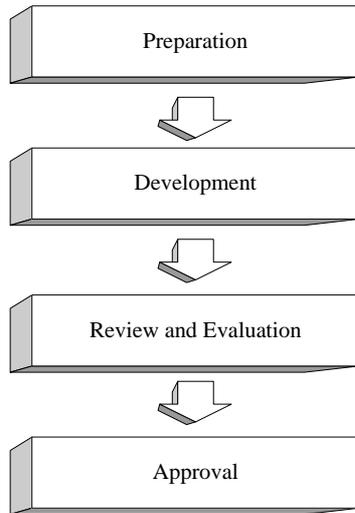


FIG. 5: Procedures for Developing a Standard

The major tasks in the preparation phase include,

- Developing a project team.
- Developing a detailed project execution plan.
- Organizing a project kick-off meeting.

The development phase includes tasks for developing standards, such as,

- Gathering requirements.
- Performing tests and experiments.
- Hosting workshops.
- Drafting standards.
- Soliciting feedback to the draft.

The tasks involved in review and evaluation vary according to different categories. A national level standard requires tremendous amount of work for the tasks. Major types of tasks include,

- Processing feedback and comments.
- Testing design or construction.
- Preparing documents for review.
- Organizing review.

The final step, approval, involves tasks such as

- Preparing final standard documents.
- Preparing final submittals.
- Acquiring approval.

3.3 Revising Existing Standards

It is unavoidable that a standard may be subject to revisions or termination over time due to social and technical changes. In China, it is required by law that a standard must be reviewed no more than five years after its adoption or previous revision. In some cases, reviews to existing standards are performed sooner due to the rapid changes of technology.

There are in general two review approaches that are currently applied, by mail or via workshops. A review is normally organized by the standard administration organization, and participated by members who developed the

original standards. A review is mainly focused on the appropriateness of the technical requirements and the criteria set by the standard.

After the review process, a recommendation regarding a standard is either valid as is, or to be revised, or to be terminated. Such recommendation requires further approval from the responsible standard administration department.

4. CONCLUSIONS

This paper discusses the categorization, classification, management and revision of information standards for the Chinese construction industry.

The discussion clearly reflects that in China a standardization effort is not a sporadic or random activity. Rather it is a nationwide systematic exercise, which is also part of government function. Such an effort is more ambitious than just setting some technical criteria. It is well-aligned with the social and economic development goals of the nation, such as informatization and the compliance with standards set by WTO (World Trade Organization). Such intent is also reflected in the categorization and classification of construction standards, in which construction standards are placed within the scope of national standards and have very close relationships with standards developed by other industries such as the computer and information technology.

Technically, it seems that the organizing system is sufficient. The categorization, classification and the coding of standards serve well to establish a complex, yet effective, web of a nationwide system for standardization. The classification and the classification tables are developed to organize the standards. It is however not clear as to the usefulness of the different classification schemes. It seems that the typical classification is representative enough because it combines the features of the other two classification schemes; while other two may only serve as a complementary tool to the typical classification.

One of the issues related to the development of standards in Chinese construction industry is the coordination for developing and maintaining such a complex system within the construction industry, and the management of many concurrent standardization efforts across different yet related industries. It is a great challenge to effectively deal with such an issue nationwide. In addition, it requires tremendous amount of resources for such coordination and management efforts.

In addition, the development of standards takes a top-down approach because a standardization project must first be included in a plan developed by the Ministry of Construction of China. To better understand this, one needs to have some background knowledge about the tradition and the culture of the Chinese construction industry in order to know why China is undertaking such a great effort as government function.

5. REFERENCES

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