

A Study of the Information Classification for Railway Industry

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Abstract

Information management of products and services in every industries is gaining importance for resource planning and maintenance. In this paper, we analyzed the information classification systems for railway industry. International and domestic classification systems, such as HS, UNSPSC, eCl@ss and ISIC, are reviewed; as a result this paper presents the findings and the various issues. We proposed to-be images in adopting and utilizing the classification systems. Using the integrative information classification systems could make efficient electronic procurement, supply chain management and e-Business of railway services.

Keywords: Information classification, Railway services, Classification systems

1. Introduction

It is necessary to systematically manage facilities and products in railway industry for resource planning and maintenance of them. In addition to the physical factors, management of their information is gaining importance in today's business environment. Enterprise information systems, such as ERP (Enterprise Resource Planning), deal with the information of facilities, products, parts and services. For example, Deutsche Bahn AG classified some 160,000 spare parts for rolling stock according to the eCl@ss standard with integration in the ERP system [2].

Information of products/parts relates to the purchasing business. It means that it is not reasonable to manage the information for individual enterprise. That is, information sharing and integration prove to be easy when two companies or more use the standardized classification scheme for products and parts. If railway companies do not take interest in the standardized classification systems and do not equip themselves with them, their global competitiveness could weaken.

There are several international classification standards of products and services for general purpose. Although they

did not fully consider the domain characteristics of railway industry, it could be helpful to review classification methods and the relationship among them for management and utilization of information. Information classification systems would be the digital infrastructure for e-Business of railway industry. Based on the infrastructure it could be convenient to utilize e-Catalogue, to prepare electronic procurement and to integrate supply chain management system.

In business outsourcing, statistical analysis and performance analysis by functions or units of work, it is also necessary to have well-organized classification systems. Though there are standard classification systems of economic activities, they are not deeply itemized and have different hierarchies from other systems. Furthermore, mapping and integration of heterogeneous classification systems is difficult.

There exist many studies about classification systems. However, most of them deal with electronic commerce as the subject and do not focus on railway services. e-Catalogue standardization activities for public procurement in EU are reviewed focusing on the product classification systems [3]. Hepp (2007) presents a quantitative analysis on items and attributes of four international products classification systems [5].

In order to improve classification systems in construction and logistics industry, several researches proposed new schemes. Kim (2003) analyzed the information classification system of subway construction and suggested an

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approach for the improvement of facility and work classification system of it [6]. Government driven R&D projects had been executed about classification systems of construction information [11,12]. However, these are not closely connected with international standards. Chang (2009) proposed a classification scheme for analyzing the interfacing characteristics of logistics equipments and suggested a semantic methodology for presenting them [1]. Semantics considerations on information classification are devoted these days [4,7,9].

Classification systems of railway facilities are considered in a few studies from the viewpoint of maintenance [8,13]. However, they also did not use standardized methods. As Deutsche Bahn AG adopts eCl@ss standard, it is necessary for each company to use the standardized classification systems of products and services and to integrate them with their collaborative partners.

In this study, we reviewed the current international standards of information classification, analyzed contents and suggested issues of them which are related with railway. In addition, we proposed future image for using information classification system in railway industry. This paper is structured as follows. In section 2, we give an introduction to the standards and examine the codification schemes and contents about railway industry. Section 3 discusses the issues of classification systems and railway specific problems. In section 4, we describe a plan of future image for using classification systems for railway. Finally, we draw our conclusions and discuss the further studies in section 5.

2. Current Status of Information Classification for Railway Industry

2.1 Classification Systems

Most products classification/identification systems are used for the purpose of cataloging, procurement and electronic commerce. The representative systems are HS (Harmonized Commodity Description and Coding System), UNSPSC (UN Standard Products and Services Code), eCl@ss and NCS (NATO Codification System). In order to classify industries and related matters, several systems such as ISIC (International Standard Industrial Classification of all economic activities) are employed. UNSPSC classify both products and services. Table 1 compares the systems briefly.

HS is an internationally standardized system of names and numbers for classifying traded products. It is developed and maintained by the World Customs Organization (WCO). eCl@ss that is standardized in Europe, especially in Germany, is for electronic commerce and ERP. As previously stated, Deutsche Bahn AG adopted it. NCS is extended to a open technical dictionary for electronic commerce as eOTD (ECCMA Open Technical Dictionaries) for general purpose.

United Nations maintains two product classification, CPC (Central Product Classification) and SITC (Standard International Trade Classification). The former considers product's characteristics and economic activities and the latter is used to classify the exports and imports of a country to enable comparing different countries and years.

Table 1. Comparison among global classification systems [3]

	UNSPSC	eCl@ss	GPC (GDSN)	eOTD	NCS
objective	commercial procurement	products classification and description	product identification model	description of locations, goods, services and etc.	exchange of logistics info.
open standard	Yes/Available for free	Yes/Available for free	Available for free	Yes/Available for free	No
hierarchy	4 levels+Business Ftn.	4 levels	4 levels	Assigned to several external class hierarchies	2 levels
mapping	N/A	distribution of mapping tables starting with Ver.4.0	N/A	N/A	N/A
update frequency	quarterly	every 2 years (release every 6 months)	quarterly	monthly	bimonthly
multi-languages	11	6	english	7	13
number of items	18,000	75,000 (keywords)	N/A	60,000	N/A
geographical focus	global (USA)	global (Europe)	global	global (USA)	global(NATO)
suitable for use in e-Catalogues	only in combination with others	in combination with GPC	in combination with eCl@ss	only in combination with other nomenclatures	N/A

Since most classification systems had not considered attributes of the products abundantly [5], it was not easy to semantically integrate information of items in them. These days, several product classification systems consider the attributes of products. eCl@ss gives value to each attribute according to the standard sets of attributes (SSA). eOTD and GPC (Global Product Classification) provide technical dictionaries using basic properties and their values to make it possible to exchange information easily.

Most widely used industrial classification systems, ISIC provides 21 sections(categories). In Korea, KSIC adopting ISIC added its own classification schemes.

The representative coding systems to classify both products and services are UNSPSC, eOTD and Uniclass. UNSPSC is for use throughout the global eCommerce marketplace. GS1 US and UNDP are responsible for management of it. Uniclass is the Unified Classification for the construction industry, published in 1997 in UK by the construction project information committee.

2.2 Information Classification About Railway

Even though the subjects of this study, products and services in railway industry, are dealt with in every classification systems, they did not have unified forms and the hierarchical structure of them vary from others. Since some systems divide items into classes according to their functions, there could exist redundancy and it could be difficult to classify them because complexity the functions can grow. The following is a review of parts of the systems about railway.

Several codes of HS system which are related with railway or tramway (hereafter RT) is shown as Table 2. 'RT

Table 2. Railway-related item classification of HS system

Code	Description
86.01	Rail locomotives powered from an external source of electricity or by electric accumulators
86.02	Other rail locomotives locomotive tenders
86.03	Self-propelled RT coaches, vans and trucks, other than those of heading 86.04
86.04	RT maintenance or service vehicles
86.05	RT passenger coaches, luggage vans, post office coaches and other special purpose RT coaches
86.06	RT goods vans and wagons
86.07	Parts of RT locomotives or rolling-stock
86.08	RT track fixtures and fittings mechanical signalling, safety or traffic control equipment for railways, tramways, ...
86.09	Containers specially designed and equipped for carriage by one or more modes of transport.

locomotives, rolling-stock and parts thereof; RT track fixtures and fittings and parts thereof; mechanical traffic signalling equipment of all kinds' are classified into 9 groups by code '86'. In case of Uniclass, 'D1-Utilities, civil engineering facilities' among 15 tables includes railway facilities. UNSPSC provides only 2 categories of cars, supporting equipment and systems. eCl@ss classify rail vehicles and parts into 3 groups, and the third group includes new types of rail, maglev train, monorail and etc.

The code mapping example of HS system onto eCl@ss, CPC and SITC is shown in Fig. 1. In this figure, we can find that each classification system has its own hierarchical levels, and the concepts of inclusion and division are mixed.

From the viewpoint of services and economic activities, we examined ISIC Rev.4, KSIC Rev.9 and UNSPSC ver.11. To the databases of ISIC and KSIC [10,15], we raised a query of selection with a word 'rail'. ISIC have 12 items out of 766 and KSIC have 11 items (except items with 'trail') out of 1936. As shown in Table 3 and 4, dif-

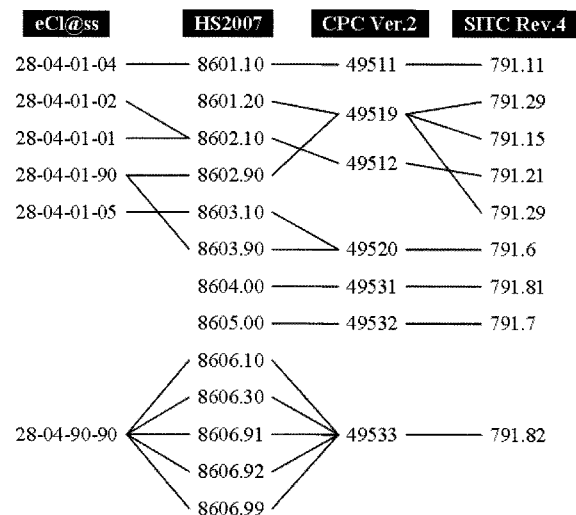


Fig. 1. A mapping example of product classification systems

Table 3. Classification of railway-related services in ISIC, Rev.4

Code	Description
302	Manufacture of railway locomotives and rolling stock
421	Construction of roads and railways
491	Transport via railways
4911	Passenger rail transport, interurban
4912	Freight rail transport
492	Other land transport
4921	Urban and suburban passenger land transport
5221	Service activities incidental to land transportation

Table 4. Classification of railway-related services in KSIC, Rev.9

Code	Description
312	Manufacture of RT locomotives and rolling stock
31201	Manufacture of locomotives and railway rolling stock
31202	Manufacture of parts for railway rolling stock and related equipment
41222	Construction of bridges, tunnels and railways
42135	Special railway laying works
491	Interurban rail transportation
4910	Interurban rail transportation
49211	Commuter rail systems
52911	Supporting, railway transport activities

Table 5. Classification of railway-related services in UNSPSC

Code	Description
7810	Mail and cargo transport
781016	Rail cargo transport
781019	Intermodal cargo transport
7811	Passenger transport
781116	Passenger railway transportation
78111601	Light rail vehicle transport LRV services
78111602	Subway transport
78111603	Continental or inter continental rail services

ferent codes of ISIC and KSIC happen to be assigned to the items in same meaning. And the depth of division differs. KSIC often assigns many activities to a code without subdividing codes. It would be reasonable to organize the items more compatibly for international usage.

Table 5 presents several items in UNSPSC. Mapping operations onto other systems are needed as stated above about products classification. For example, a code ‘4911’ of ISIC corresponds to a code ‘7811’ of UNSPSC.

3. Issues Analysis

3.1 System-level Issues

Code-based systems require consistency check and modification of the scheme in changing information of classified items. Moreover, it is difficult to find synonyms and there could be falling-off in accuracy in searching items. And an item which have two super-items is not allowed in one-dimensional codification system.

As mentioned before, information exchange problems could occur when the items of a classification system are not mapped onto those of others. In addition, lack of con-

sistency in classification hierarchies makes it difficult to match them.

3.2 Item-level Issues

Most classification systems for products and services can not reflect railway specific characteristics. Moreover, the systems were not used universally in railway industry. Although several information classification systems are used in construction industry, it does not focus on railway services. By reason of these, the number of items that are related with railway is not enough to manage information.

Because it is hard to classify various sub-items by the consistent criteria in extending an legacy system, items classification in detail by industries is required. In case of KSIC-9, 175 items (activities) which have a substring ‘철도’(railway in Korean)’ are assigned to 34 codes. Work breakdown should be standardized according to the classification systems of economic activities.

In addition, lack of terminological completeness should be improved in defining and using terms of products and services.

3.3 Attribute-level Issues

Defining the attributes of products and services makes it possible to clearly state the specifications of them. As mentioned in section 2.1, most classification systems did not have enough attributes. The classification schemes of attributes like the SSA of eCl@ss should be constructed and should be used for intelligent information system.

Mapping operation onto other systems from the side of attributes is also needed. And newly considered attributes should be corresponded to the old ones.

According to a precedent study [1], there were problems such as redundancy and inconsistency in an information system with a classification system as follows;

- composite attributes are used frequently
- relationships between products like inheritance happen to be inconsistent
- descriptive style for attributes lacks consistency
- a term is used for diverse attributes
- attributes of parts are included as those of products
- attributes that have same meaning are used under different names

4. Future Direction of Information Classification for Railway Industry

4.1 Integration of the Classification Systems Reflecting Domain Characteristics of Railway Industry

As examined in section 2.2, even though most classifica-

tion systems deal with products and services of railway industry they could not reflect railway-specific characteristics and they show inconsistency. Therefore, it is necessary to integrate the systems satisfying the requirements of railway industry and to make it the standard. Moreover mapping operations onto international and de facto standards should be made to increase compatibility. In addition, persistent data cleansing should be done.

4.2 Using Classification Systems in Product modeling

In data modeling of products and parts based on the international standards such as PLIB (ISO 13584) and STEP (ISO 10303), classification systems should be adopted. It could make the product life-cycle management more integrative in the area of product design, parts procurement, manufacturing, recycling and disposal. PLIB represents the content of a parts catalogue as a class hierarchy [14]. Fig. 2 shows not only a screenshot of editing hierarchy with PLIBEditor but also a part of a STEP-File as a result of it. The hierarchy is based on the main-group '28-04 Vehicle (railborne)' of eCl@ss, which include rail vehicles and parts.

4.3 Construction of Basic Ontology

In order to make use of intelligent information system, it is necessary to build a basic machine-understandable ontology. The ontology is built by exactly defining relationships between the items such as inheritance and the attributes of them and by semantically connecting the relationships. The semantical methodology that was proposed

in a precedent study [1] could be used.

4.4 Establishment of a Railway e-Business System

Through utilizing the standardized classification systems in establishing an e-Business system in railway industry, following advantages could be obtained. With the e-Business system, it could be possible to increase competition between the suppliers.

- information sharing with cooperative suppliers/buyers
- discovery of new suppliers even for railway specific products and services
- efficient management of master-data of items and parts
- efficient inventory control and cost reduction
- understanding of detailed description of products and services

6. Conclusions

Information management of products and services is necessary to resource planning, parts procurement and maintenance. Especially, the standardized information classification is crucial to the business collaboration.

In this study, we analyzed the information classification systems for railway industry and suggested several issues among them. Besides, we proposed to-be images in using information classification for railway industry as follows.

- Integration of the classification systems reflecting domain characteristics of railway industry
- Using classification systems in product modeling
- Construction of basic ontology

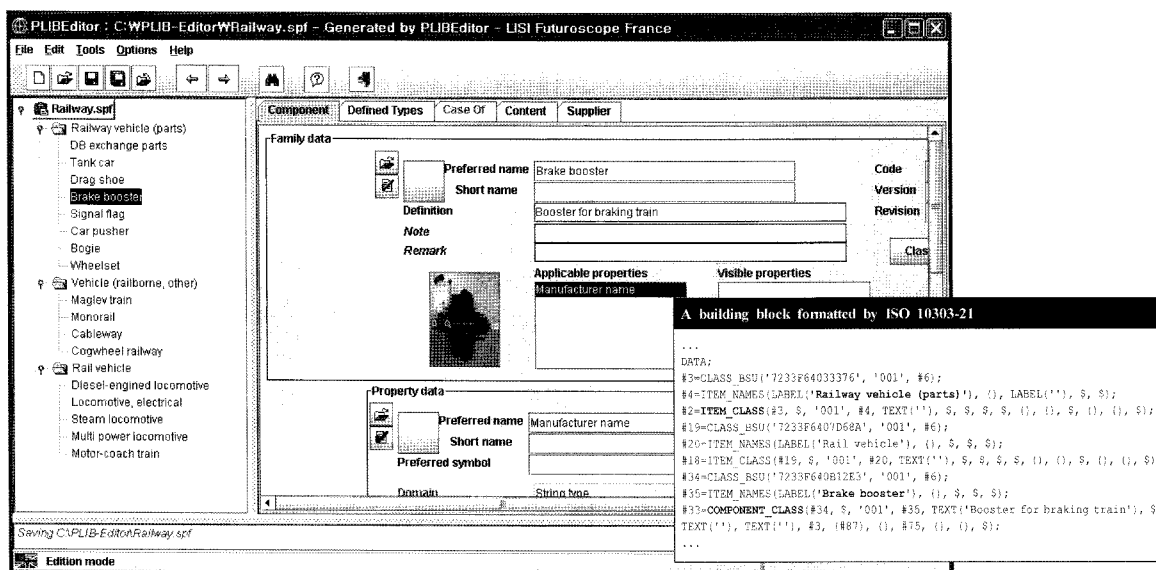


Fig. 2. A screenshot of PLIBEditor and a generated message file

- Establishment of a railway e-Business system

Additional studies on the integration of information classification schemes, which are currently used in railway industry, need to be done in detail. Adaptability of the standards should be checked in addition.

Integration, standardization and employment of the information classification systems could make efficient the supply chain management and e-Business in railway industry.

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