Challenges and Opportunities for Logistics Standardization in Asia-Pacific Countries: A Descriptive Case Study

Abstract: As a growing number of multinational firms want to join the global supply chain network that require them to share infrastructure, information, and process with their trading partners, logistics standardization has moved to the center stage of globalized logistics activities. We discovered that logistics standardization could pose various challenges due to marked differences in business customs, culture, infrastructure, and government policies. As compared to U.S. and EU nations, the extent of logistics standardization in both China and Korea is limited due in part to the lack of promotional and enforcements made by their governments and the absence of regional organizations that can actively initiate and unify multi-national logistics standardization efforts. Based on descriptive case studies, this paper examined the current logistics practices of two emerging economies (China and Korea) in the Asia-Pacific region, identified the lack of logistics standardization as the sources of their logistics inefficiency, and then developed theoretical underpinnings of logistics standardization and its managerial implications for multinational firms which are engaged in global logistics activities.

Key words: logistics standardization, global supply chains, case study

Paper type: Research paper (expository paper)

1. Background

As the globalization of business activities has spurred growth in international trade, there is a growing need for international standardization. In particular, as trade barriers continue to crumble and the whole world becomes a single market in the wake of a formation of the World Trade Organization (WTO), the establishment of global logistics standardization is essential for a continued growth in international trade and the subsequent increase in cargo shipments. Indeed, standardization goes beyond the issues of suitability and interchangeability of products from technical perspectives and has begun to evolve into the source of competitiveness (Blind, 2004). For example, the level of logistics standardization is directly related to price competitiveness. The lower the level of logistics standardization in a country, the greater the cost of logistics and the less price competitive in that country. Although sources of high logistic costs are diverse, one of those sources may include the lack of logisics standardization. In other words, countries that can initiate international standardization will likely dominate the logistics market, whereas countries that failed to do so will not even survive in the logistics market. As such, international organizations and agencies tend to encourage multinational firms (MNFs) to use international standards so that those MNFs can lower technical barriers and develop level-playing fields in the global marketplace. Accordingly, many countries made conscious efforts to adopt newly established or revised international standards.

Especially, advances in IT (Information and Technology) coupled with relevant and interchangeable communication standards facilitated information exchanges and the subsequent cooperation among different countries. Such cooperation, in turn, will enhance the global supply chain visibility and the market uncertainty that can contribute to cost savings. Despite the importance of international standardization, most Asia-Pacific countries seldom take international standardization seriously due in part to their socio-economic and political differences. For example, maritime logistics standardization involving containers, pallets, and documentation is very limited in the Asia-Pacific region including China, Korea, and Japan. Likwise, standardization is deficient in the railroad transportation industry in the Asia-Pacific region as evidenced by inconsistent tracks, freight container sizes, and traffic signals among different Asia-Pacific countries. This lack of standardization contributed to inefficient logistics operations in the Asia-Pacific region which suffered from rising logistics costs. Currently, the ratio of logistics costs to the national GDP (Gross Domestic Product) is relatively high in Korea, China, and Japan. For instance, in 2006, a total logistics cost in China is estimated to be 3.8414 trillion yuan that represents a 13.5% increase from the previous year. It accounts for 18.3% of the total GDP in China. In Korea, its total logistics cost comprises 12% of its GDP. These figures are significantly higher than those (7-9%) of developed countries such as Germany and United States (U.S.) (Ojala, 2010). These disproportionately high logistics costs in these Asia-Pacific countries (especially China) may have an adverse impact on their global competitiveness. Such an impact will only get larger with increases in international trade and logistics activities. That is to say, to sustain a high level of global competitiveness, Asia-Pacific countries need to reduce their logistics costs through logistics standardization comparable to European Union (EU) standards.

As a matter of fact, some Asia-Pacific countries such as China, Korea and Japan plan on develping a single, unified logistics market among them by establishing international logistics standards. The recent emergence of China as the world's economic power also instilled a sense of urgency for logistics standardization. Logistics standardization may start with the martime logistics market in Northeast Asia. Another target of the logistic standardization includes Asian Highways in UN ESCAP and Eurasian railroad networks. Logistics standardization in Asia-Pacific countries is essential for adapting to gradual shifts in the use of transporatation modes from either maritime or air transportation to intermodal transportation including piggy-backs and birdy-backs.

To sustain the high level of economic growth in the Asia-Pacific region by leveraging the unified logistics market, Asia-Pacific countries need to understand their current logistic status, identify their pressing logistic issues, and address those issues through cooperative efforts. These efforts include the establishmet of consistent logistic policies and guidelines for Asia-Pacific countries that can help save their logistics costs and reduce transit time among them, while modernizing and standardizing their logistics facilities, equipment, and processes. This research represents part of such efforts and aims to understand the current status of logisics standardization and direct future standardization and cooperative efforts by Asia-Pacific countries such as Korea and China.

To elaborate, this research focuses on the following contents;

First, this research identifies the status of logistics standardization in Asia-Pacific countries. To elaborate, this research examines the extent of global logistics standardization associated with international freight movement, storage, documentation, and information exchange/transfer in the Asia-Pacific region (especially Korea and China).

Second, this research analyzes logistics standardization policy, rules, and regulations in Asia-Pacific countries such as Korea and China.

Third, this research attempts to find ways to enhance synergies for logistics standardization among Asia-Pacific countries.

2. Relevant Literature

In general, standardization refers to the process of establishing a compatible and interchangeable concept, design, specification, procedure (practice), and doctrine that can increase commonality of products, processes, and systems. Often the primary goal of standardization is to improve efficiency in building products, formalizing processes, and developing systems. In particular, standardization has become a popular subject of discussions in the information and communication technology (ICT) literature (Formin et al., 2003). The common motives for ICT standardization are greater competitive advantages and monopolistic benefits resulting from the exclusion of competing organizations from the ICT standardization (Besen and Farrell, 1994; Schilling, 1998). For example, organizations which did not participate in ICT standardization will have increased difficulty in sharing databases, software, and documents due to incompatible ICT standards. As a matter of fact, the lack of ICT standards is one of the foremost hurdles for the adoption of ICT in the logistics sector (Evangelista and Sweeney, 2006; Perego et al., 2011).

Despite a significance of ICT standardization to the firm's competiveness, it still can be a risky proposition given its increased scope, scale, and complexity (Garud et al., 2002). Also, standardization typically necessitates significant changes in behaviors, practices, and strategies of the affecting organization. As such, each organization prefers its own ICT as the industry standard, rather than its competing rival's ICT. This tendency creates competition between two rival organizations for the adoption of their own ICT for standardization and thus poses another difficulty in developing standards that can be agreed-upon by both parties. Considering these challenges, standardization should begin with the efforts to foster the atmosphere of cooperation and coordination among potential adopters of standardization. These efforts are particularly important in the logistics sector where timely and accurate information about the movement of goods can greatly enhance the supply chain visibility and subsequently facilitate the more efficient handling of inventories/shipments and the smoother exchanges of necessary documents.

Recognizing the significance of standardization to cost-efficient logistics operations, several European automakers and their suppliers standardized their cardboard and resusable packages which had 8 to 20 different types and sizes (Fabbe-Costes et al., 2006). Extending the scope of logistics standardization for the automotitive industry, the Chinese automotive industry recently attempted to develop universal industry norms, uniform terminology, and technical specifications for automotive logistics services, but encountered various challenges due to lack of coordination and systematic guidelines/policies to follow (Youngjun Time, 2009). Thus, there is an urgent need for a study that can develop a conceptual framework of logistics standardization and propose workable guidelines/policies. Nevertheless, this line of study is scant in the published literature, although there were some pioneering research work in the past. These include Manrodt and Vitasek (2004) who conducted a case study of the high-tech company to identify its global supply chain processes critical to its business success, determine which processes it should initially standardize, and then suggest ways to implement global process standardization strategy. Later, Fabbe-Costes (2006) discovered that logistics standards such as packaging and label standards could work as the coordination mechanism that improved interconnectivity among logistics activities and subsequently enhanced logistics efficiency based on the case study of three Euproean car manufacturers. Both of these studies raised the issue of logistics standardization in the global supply chain context for the first time. However, these prior studies are confined to the limited aspects (e.g., process, packaging, label standards) of logistics standardization and are mainly based on the focused case study of a particular company representing high-tech and automotive industry. To fill the void left by these earlier studies, this paper looks at the entire spectrum (e.g., equipment, process, packaging, container, ICT including radio frequency identification (RFID) and electronic data interchange (EDI)) of logistics standardization in a global setting and then develops its macro-perspective at the country and regional level (i.e., Asia-Pacific). Also, this paper intends to propose policy guidelines useful for global logistics standardization.

3. **Research Methodology**

Since the primary objective of this study is to uncover the sources of difficulties associated with logistics standardization across multiple countries and find ways to ease such difficulties, it is approroiate for us to examine the current efforts of logistics standardization in Asia-Pacific countries and identify best-practices that can help Asia-Pacific countries formulate viable strategies needed for facilitating logistics standardization and intenational cooperation based on the the case study of Korea and China representing the economic powers of the Asia-Pacific region. In addition, to see whether the EU's logistics standardization model can be successfully adopted by the Asia-Pacific countries, we analyzed some available secondary data and then actively consulted with logistics experts who are faimiliar with Asia-pacific countries' unique logistics systems and practices. In particular, we consulted with logistics experts from Korea and China. These experts are identified through the academic network formed by the Korea Maritime Institute (KMI), while conducting the United Nations Development Plan (UNDP) workshops. These experts played an important role in investigating their own countries' logistics standardization efforts/status and their own government's policy directed toward logistics standardization.

4. A Conceptual Framework of Logistics Standardization

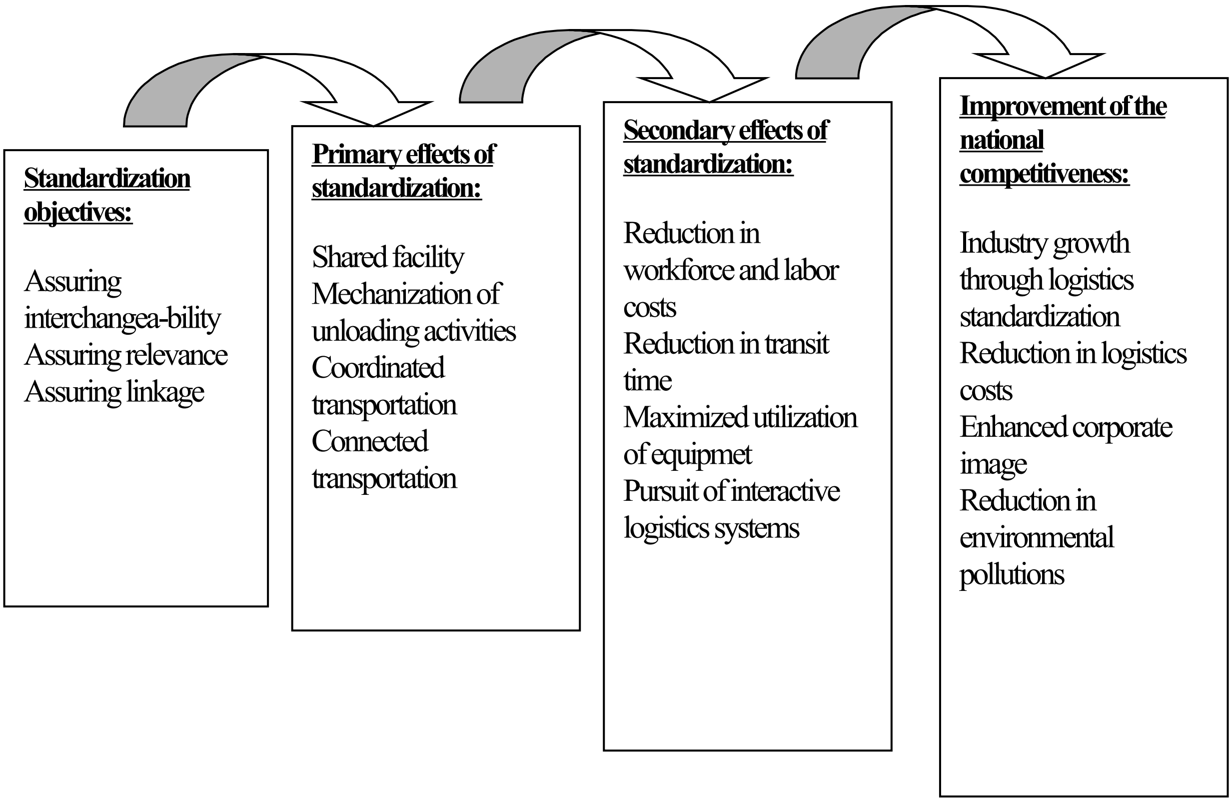
Logistics standardization refers to the concerted efforts of simplifying and unifying logistics hardware such as facilities (e.g., terminals, distribution centers), equipment (e.g., lift trucks, conveyors), and tools (e.g, packages, containers, pallets) as well as software intended for facilitating logistics information, asset, and monetary flows through coordination and cooperation among supply chain partners. To elaborate, International Organization for Standardization (ISO)'s Standardization Safety Committee proposed the following seven guidelines for standardization: 1) Standardization aims to prevent unnecessary confusion and complexity by simplifying social tasks. 2) Standardization is based on concerted efforts by all economic and social sectors. 3) Standardization aims to protect the majority's interests. 4) Standardization should target selected activities and should persist. 5) Standardization is subject to review and change, if necessary. 6) Standardization should take into account the nature and idiosynchrocy of the product to be standardized. 7) Standardization requires the careful consideration of the nation's stipulations and their enforcements. Based on these guidelines, the main targets of logistics standardization are packaging (including pallets), transportation, loading/unloading, storage, and ICT as specified below.

1) *Packaging standardization* is concerned with the standardization of packaging size, materials, weight, strength, management and recycling guidelines.

2) *Transportation standardization* is primarily targeted for the size of freight containers and rail cars that can accommodate palletized shipments.
3) *Storage standardization* is intended for unifying generic storage facilities, automated storage facilities, storage racks, logistics hubs, freight terminals, equipment, and safety processes.
4) *Loading/Unloading standardization* is targeted for the size, capacity, terminology, parts, and safety processes associated with lift-trucks, pallet trucks, conveyors, palletizes, and robots.
5) *ICT standardization* aims at standardizing electronic data interchange (EDI), bar codes, bar code scanners, RFID, logistics execution systems, and their interfaces and relevant software.

Regardless of its target areas, the ultimate goal of logistic standardization is to improve logistics efficiency through the elimination of redundancy, waste, and duplication. From a macro perspective, the improved logistics efficiency will lead to the enhanced competitiveness of a nation in the global marketplace as shown in Figure 1.

Figure 1. The Potential Effects of Logistics Standardization



5. A Current Status of Logistics Standardization in Asia-Pacific Countries

The logistics standardization initiatives have started with the standardization of pallets. For example, the U.S. began with the standardization of 1200×1200mm pallets, while EU began with the standardization of 1200×800mm pallets. Likewise, Korea initiated the standardization of 1100×1100mm (so-call T-11) pallets and encouraged their use as its national (KS) standard in the Korean logistics market. These differences in pallet standardization intensify each nation's efforts to impose its own logistics standards on the other countries. Also, the ISO stepped in these efforts to unify the global logistics standards. To make these efforts successful, we should investigate the current status of logistics standardization in the Asia-Pacific region and identify differences in logistics standardization among Asia-Pacific countries. For illustrative purposes, we will primarily look into the cases of Korea and China.

5.1. The Case of the Republic of Korea

As of 2004, the total number of logistics firms active in the Korean logistics market reached 163,000. As the Korean logistics market grows at an annual growth rate of 7%, the role of the Korean logistics sector in its economy has significantly increased. Considering the increased role of the logistics sector in the Korean economy, the Korean government has begun to explore various ways to improve the efficiency and the subsequent competitiveness of its logistics sector. One of those ways includes logistics standardization. The Korean logistics standardization effort started with the enactment of the basic logistics policy rule (Rule #8617) on August 3, 2007 which aims to stabilize the domestic logistics market, increase the global competitiveness of the Korean logistics industry, and modernize logistics operations through the necessary amendment of government logistics standards and policies/strategic plans. The leading government agencies which initiated such effort are the Ministry of Construction and Transportation, the Ministry of Maritime, and the Ministry of Industrial Resources. The Techology Standard Committee formed by these agencies expects to standardize 85% of Korean logistics systems and reduce the national logistics expendure by 100 billion won (roughly $100 million) by 2015.

Since export-oriented countries such as Korea heavily depend on containerized shipment for international trade, a container along with the pallet has been the initial target of logistics standardization in Korea. Generally, a container is designed to withstand the internal and external stress casued by the repeated use, to smooth intermodal transfer, and to ease loading/unloading operations during transshipment. Although a container is typically standardized across the globe with 35.3 cubic feet (1m³) of shipping capacity, North American and Eupean countries interchangeably use containers of two different sizes: one in compliance with their domestic standards and another in compliance with ISO standards. Similar to these practices, Korea uses two separate standards depending on the destination of containerized shipment: one for domestic and another for international. Details of the Korean logistics standardization efforts including container standardization are provided below.

5.1.1. Domestic Container Standards. The size of a general freight container (S A 01720) intended for domestic distribution and intermodal transportation (trucks, rails, ocean carriers) is as follows: The seven different container size includes: 8-feet, 10-feet, 20-feet and 30-feet with a maximum loading capacity of 5 ton and 10 ton. Mostly, 10-feet containers are used for domestic transportation. In contrast with Europe and Japan, Korea seldom uses its domestic containers.

Table 1. The Size of a Domestic Genral Freight Container

Type and Name	Length(mm)			Width(mm)			Height(mm)			Total weight(Kg)
	Standard size	Minimum length	Allowable margin	Standard size	Minimum width	Allowable margin	Standard size	Minimum height	Allowable margin	

Type1	1D1	2,991	2,801	-5	2,438	2,330	-5	2,438	External height-241	-5	5,000
	1D2	2,991	2,801	"			"	2,591		"	5,000
	1C1	6,058	5,867				"	2,438		"	10,000
	1B1	9,125	8,931	-10			"	2,438		"	10,000
Type 2	2E1	2,438	2,248	-6			"	2,438		"	5,000
	2E2	2,438	2,248	"			"	2,591		"	5,000
	2C2	6,058	5,867	"			"	2,591		"	14,000

5.1.2. International Container Standards. The box style container (e.g., closed, pass through, ventilated, open-top) that is used for product shipment and international trade or the general freight container has the following sizes in accordance with KS A ISO 668, KS A ISO 1496-1): The size of an international container can be: 20 feet, 30 feet, and 40 feet along with 10 feet meeting KS standard. Among these, both 20-feet and 40-feet containers are primarily used. The 10-feet container is used for trade between Korea and China, while 6-feet, 12-feet, and 20-feet JR containers are occasionally used for car-ferry voyage between Korea and Japan or for domestic shipment. But, 10-feet containers are rarely used on any accasion.

Table 2. The Standard Size of the International Freight Container

	Length(mm)			Width(mm)			Height(mm)			Total weight(Kg)
	Standard size	Minimum length	Allowable margin	Standard size	Minimum width	Allowable margin	Standard size	Minimum height	Allowable margin	
1AAA	12,192	11,998	-10	2,438	2,280	-5	2,896	External height-241	-5	30,480
1AA	"	11,998	"	"		"	2,591		-5	"
1A	"	11,998	"	"		"	2,438		-5	"
1AX	"			"			<2,438			
1BBB	9,125	8,931	-10	2,438		-5	2,896		-5	25,400
1BB	"	8,931	"	"		"	2,591		-5	"
1B	"	8,931	"	"		"	2,438		-5	"
1BX	"			"			<2,438			
1CC	6,058	5,867	-6	2,438		-5	2,591		-5	24,000
1C	"	5,867	"	"		"	2,438		-5	"
1CX	"			"		"	<2,438			
1D	2,991	2,801	-5	2,438		-5	2,438		-5	10,160
1DX	"			"			<2,438			

Since Korean export and import shippers mostly use ISO-certified 20-feet or 40-feet containers that are popular in internal trade, they seldom have container transportation problems. However, in contrast with North America and Europe, the Korean shippers seldom use their domestic containers despite the availability of standardized domestic containers. As of 2007, 10-feet containers account for approximatelly 2% of the Korean container traffic, 20-feet containers account for 47.9%, 40-feet containers account for 49.5%, and others account for 0.6%, respectively. With an exception of 5-feet containers used for domestic transportation of citrus produced in the Jeju Island, domestic containers are rarely used in Korea. So, in Korea, international containers are frequently used for container transportation. Both 20-feet and 40-feet international containers account for 97.5% of container traffic in Korea. Occasionally, 45-feet or special international containers are used.

5.1.3. Transportation Standards. The 60-feet freight container car was designed to carry three 20-feet containers to enhance its transportation capacity and efficiency. However, the use of this car requires container measurement verification, permits (export/import permits or bonded shipping permits) for hauling a freight of 1TEU, and shipping inspections at the departing railroad station and other necessary administrative hassles that discourage the shippers to utilize this car. As such, many 60-feet freight container cars have a tendency to carry two 20-feet containers at the front and back of the car without filling in the middle of the car. This practice creates a lot of inefficiencies.

The size and shape of the container freight rail car used in Korea have not been standardized yet and thus the use of the container freight car is still limited due to empty space at its front and rear created by such inconsistency. Due to this limit, relatively inefficient 45-feet and 60-feet container freight cars are being replaced by a new type of 40-feet container freight car and thus the compatibility of containers to freight rail cars is expected to improve. Also, since the 8-feet container meets the Korean container standard, its use will be increased. However, its absence of the locking system may create difficulty in moving rail freight and transferring freight to other modes of transportation. The 40-feet container freight car that can carry one 40-feet container, two 20-feet containers, or four 10-feet containers can lock those containers at the fixed position and ship them safely. To utilize the 8-feet container freight car, it should be equipped with the built-in locking system or its fixed system should be substituted by the sliding system. Another alternative is to convert the structure of 40-feet container freight rail cars to accommodate five 8-feet containers along with 40-feet, 20-feet and 10-feet containers.

The standard of the Korean container freight car is congruent with that of the ISO container, since its width exceeds 2.5m. Thus, it has no problem in transporting international containers with an exception of some JR standard containers. The Korean rail container freight car can be classified into 2TEU and 3TEU freight cars, although there are a few rail cars that can handle 3TEU freight. If the freight rail car that is in the range of 16 - 17m carries two 20-feet containers, it can create empty space and the subsequent inefficiency.

The container that is primarily used to transport citrus to the Mokpo and Busan areas is standardized to expedite the shipment between Jeju Island and the mainland Korea. The standard established in 1999 is the container with a width of 2,438㎜ and a height of either 2,438㎜ or 2,591 ㎜. .

5.1.4. Storage Standards. The government's efforts to develop storage standards seem to focus on storage equipment. Especially, the government's rule specifies the preferential treatment of the user of standardized logistics equipment for storage. For example, the Korean Ministry of Construction and Transportation, the Ministry of Maritime, and the Ministry of Industrial Resources have the authority to ask and encourage responsible government agencies to offer special discounts in storage fees to the user of standardized storage equipment. They can also offer preferential (low-interest) loans to a user of the standardized storage equipment. Furthermore, once the government agency certififies storage equipment through the Standardized Logistics Equipment Certificate System, both the manufacturer and the user of certified storage equipment will be given government subsidies and tax exemptions/reductions. Herein, the Standardized Logistics Equipment Certificate System aims to certify and promote storage equipment that can handle a Korean standard pallet (1100×1100mm).

5.1.5. Loading/Unloading Standards. Container unloading equipment used in the exclusive container docks and railroad stations includes: gantry crane, transtainer, reach stacker, top handler, and forklift. At some of the old docks at the port of Busan, mobile cranes or general road cranes can be used to unload containers. At the car ferry docks, forklifts that are combined with tractors and chassis are used to unload containers. At the container only docks, gantry cranes are set up to unload containers, while yard tractors and chassis are used to transfer containers at container yards. The transtainer is used to unload container equipment inside the container yards, while the reach stacker is used to transfer containers. Either top handlers or forklifts are used to unload empty containers or retrieve shipments inside the container. The transtainer or the top handler is utilized to load or unload container freight cars. Currently, the aforementioned unloading equipment does not have any compatibility problems in dealing with containers such as 12-feet small containers commonly used domestically in Japan. Generally, the compatibility between the container and the chassis is not an issue. For example, for the Korea-Japan shipping route, the chassis is often used to handle the 12-feet container that is equipped with the positioning cone at its middle.

To ensure the compatibility of freight trucks and standard pallets, the Unit Load System (ULS) rules are applied to the loading capacity of mid-size trucks. Their loading capacity is 2280~2350mm in width and standardized to handle two consecutive T-11 type pallets (1100mm×1100mm). Such a capacity makes the transfer of shipment from the truck to the container easier. On the other hand, some trucks that are narrower than the ISO container standard may pose safety problems. Part of the reasons why such trucks are used is the fact that narrow alleys in small-to-mid size cities would not accommodate the standard container truck and thus it is cheaper to use regular or privately owned trucks.

The 20-feet or 40-feet ISO standard containers never posed a problem in loading/unloading cargoes at the port terminal and railroad station due to their compatibility. The only problem is a lack of standardization of spreaders that can handle 6-feet, 12-feet, or 20-feet containers used for the Korea-Japan Car-Ferry Route along with some domestic containers used by a few domestic shippers and carriers. Even though domestic containers are seldom used at this juncture, they should be standardized to be consistent with international standard containers that will be increasingly used in the future as a result of globalization. The government should promote the use of standardized domestic containers and eventually standardize both chassis and truck cargo capacity to smooth cargo transfers. Also, the 20-feet containers with the locking system should be utilized further to load and unload 8-feet or 10-feet domestic containers for rail.

5.1.6. ICT Standards. A majority of the Korean logistics firms hope to establish integrated logistics information, while obtaining real-time information regarding shipment tracing, vehicle positions, and empty vehicles. Although both the government agencies and private enterprises are in the process of establishing uniform logisics information infrastructure, interfaces among them are still lacking and thus contributed to inefficiencies and redundancies. At the government level, the Ministry of Construction and Transportation has taken initiatives to develop information systems related to surface, air, and rail transportation, while the information system in sea transportation is handled by the Ministry of Maritime. Also, the customs related information system is developed by the Customs Office. At the private firm level, carriers, shippers, and forwarders have developed their own information systems and thus posing compatibility problems.

Currently, the Korean logistics information systems are lacking the total system that can integrate logistics information across the network (customs, trade, and port management) and the logistics entities (government, shipper, logistics firms). During the vessel arrival and departure, the vessel operator needs to report to multiple parties such as the Ministry of Maritime, Customs Offices, and Immigration Offices. Also, the lack of information sharing and communication among these organizations often leads to the underutilization of empty vessles. Furthermore, the submission of duplicated documents to these authorities tends to increase document transmission fees. Considering these hassles, the Korean government authorities including the Departmennt of Construction and Transportation, Ministry of Maritime, Ministry of National Resources, Customs Office, Ministry of Legal Affairs, and Inspection

Office have made concerted efforts to develop a unified and efficient logistics information system that encompasses value added nerwork (VAN), Internet, EDI, Wireless technology, and RFID. These efforts are intended to diversify the logistics information channel, trace shipment, and integrate logistics data base services.

Ever since 1996, export and import documentation has been converted to paper-less systems using EDI that have been primarily used for sea and air transportation. Also, since 1998, the government has offered vehicle/shipment tracing services through advanced freight logistics information systems. Also, the Customs Office in alignment with the Ministry of Maritime has offered export/import and statistics services using export/import information systems (integrated DB service). The government has developed the Air Cargo Information System (AIRCIS) that integrated activities involving air freight reservation, customs information, shipment tracing and other air freight services through the One-Site One-Stop services.

EDI, however, has been seldom utilized for surface transportation. Instead of EDI, the Korean Railroad Company developed the Korean Raildroad Operating Information System (KROIS) which can provide real-time rail positioning and customer shipment record tracking capability. Likewise, many Korean carriers, shippers, and forwarders have been using their own individual logistics systems, thus creating difficulty in interacting with other information systems. For example, rail and road transport sectors experienced difficulty in analyzing inbound and outbound movement information due to a lack of interfaces. Also, warehouses and distribution centers have difficulty in obtaining advanced shipping notice information and sharing real-time information regarding inventory and equipment status. To obviate these difficulties, the Korean logsitcis industry needs to establish ICT standards that can help integrate the individual information and communication systems and link those without disruptions. Such a need led to the recent effort of the government agencies to certify the logistics information based on its interface capability and the extent of its linkage to the total logistics system.

5.2 The Case of China

In general, the Chinese logistics standardization rule aims at facilitating technological advances, improving product quality, and enhancing social-economic efficiency. This rule intends to comply with international standard guidelines such as ISO, IEC, and ITU. The rationale being that the World Trade Organization (WTO) requires its member nations such as China to develop their own national standards consistent with international standards. Currently, there exist approximately 300 internationally accepted standards set by ISO, EAN, and UCC. Given this large number of international standards, the Chinese logistics standardization rule specifies the common protocols of selecting an international standard. These protocols include inspection, analysis, testing, and approval of the quality control process consistent with the international quality standard guidelines. These protocols are based on the following principles:

1) The practicality of national quality standards should be considered from the enterprise perspective;
2) Both domestication of the international standards and globalization of the national standards should be pursued to enhance the global competitiveness of the Chinese enterprises;
3) National standards that help the balanced economic development should be prioritized.;
4) Self-improvement efforts based on the enterprise's own standards should be encouraged.

Following the above principles, the Chinese national standards are developed and administered by the Standardization Administration of the People's Republic of China (SAC) under the umbrella of the Chinese National Quality Inspection and Testing Administration. To improve logistics service quality, the Chinese government recently established the number of agencies responsible for standardizing the quality of container services, vessel transportation, and packaging. For example, in 2003, the Chinese government launched its efforts to actively standardize the logistics quality by establishing the logistics quality standardization committee and the logistics information management committee. The National Logistics Information Quality Control Committee is responsible for building the logistics information infrastructure, desigining logistics information systems, managing/utilizing essential logistics information, and developing Chinese product codes. In addition, it aligned with the logistics outsourcing committee and promoted e-commerce by developing e-commerce guidelines and digital warehousing systems in 2004. In 2005, it established comprehensive logisics quality standards as displayed in Figure 1. In 2006, it founded 10 different sub-committees that standardized logistics terminologies, classified logistics industry codes, developed/refined approximately 100 logistics quality standards including pallet standards, and established 14 international logistics service standards including 3PL-related services. At of the end of 2003, logistics-related national and industry standards reached 522 items as summarized in Table 3. More than half of these are classified as logistics management standards. Among these, 104 deal with logistics information standards, while 89 are considered to be logistics equipment standards.

Figure 1. The Chinese Logistics S

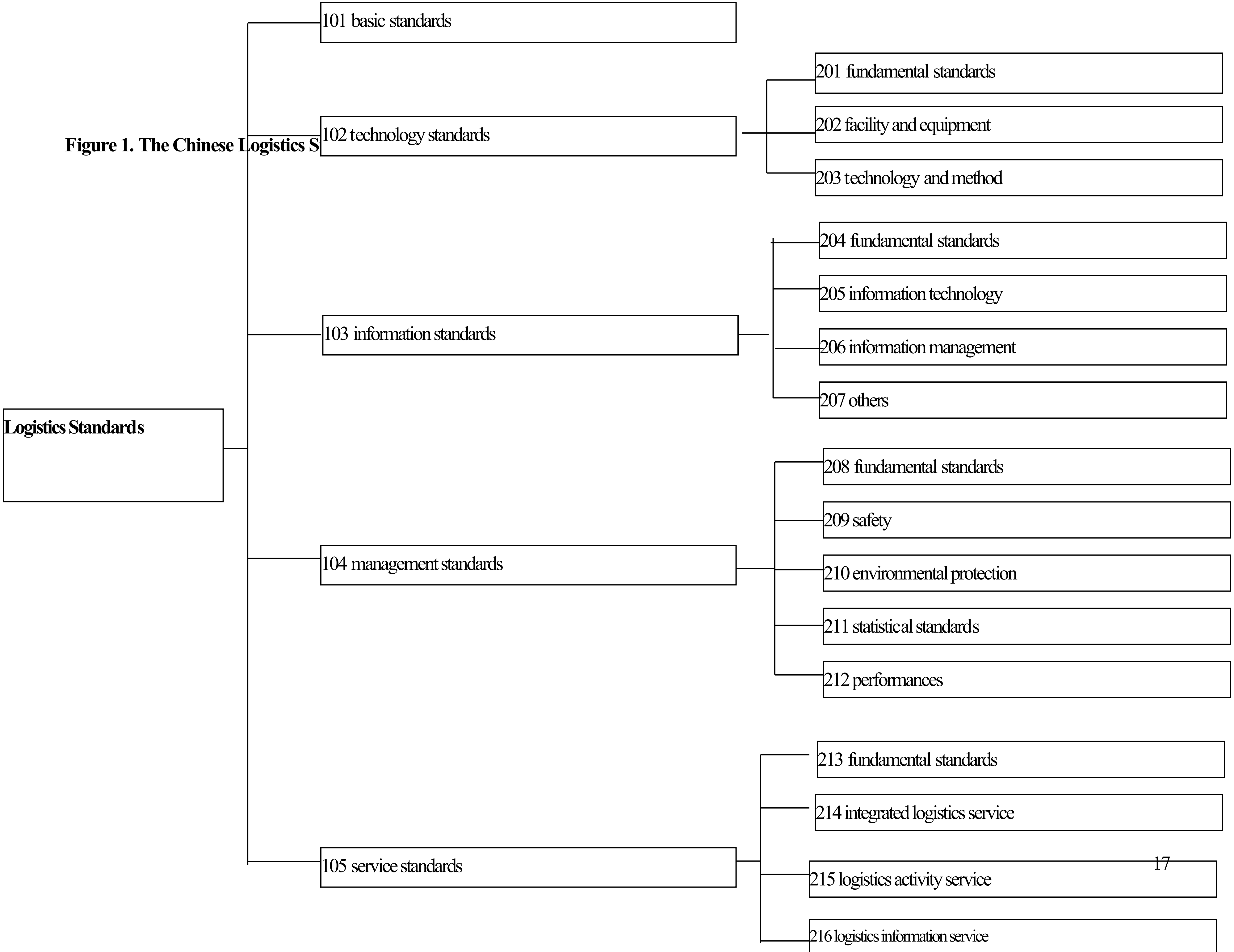


Table 3. The Classification of Chinese National and Industry Logistics

Category	Total	Logistics equipment	Logistics technology	Logistics management	Logistics information	Mandated standard	Recommended standard
National standards	331	40	36	153	101	105	226
Industry standards	191	49	27	112	3	65	126
Total	522	89	63	265	104	170	352

Source: The Chinese Logistics Standard Committee (2003)

In particular, 29 (approximately 30%) out of 77 logistics standards dealing with packaging, labeling, transportation are based on national standards, whereas 5% of pipeline transportation standards are based on international standards. Also, 24 (20%) out of 125 railroad standards are based on international standards, while 75 (30%) out of 265 motor vehicle standards are based on international standards. Furthermore, part of product barcodes and logistics construction marking are based on international standards. In 2005, eight different federal agencies such as National Standardization Management Committee, National Development and Improvement Committee, Ministry of Commerce, Ministry of Transportation, National Quality Inspection Committee, Commercial Airline Board, and Ministry of National Statistics developed mid-range plans for improving logistics standards between 2005 and 2010 as summarized in Table 4. The main purposes of such plans are to modify 300 existing logistics standards and develop new standards, while reducing discrepancies among logistics standards used by different agencies and gradually meeting international standards. As part of these plans, between 2005 and 2006, basic standards were introduced. Between 2007 and 2008, logistics technology, information, service, safety, and statistical standards were developed. During the period of 2009 to 2010, other logistics improvement standards were established. At the end of 2006, the Chinese logistics standardization committee finished up refining and developing 100 different standards.

Table 4. The Chinese Logistics Standardization Plans at Three Phases

Period	Itemized content of the plans
Year 2005-2006	Commercial basic standards
Year 2007-2008	Logistics technology, information, service, safety, and statistical standards
Year 2009-2010	Other logistics improvement and integration service plans and related service plans

5.2.1. Container Standards. The main purposes of these standards are to identify international and national standards and develop new standards for unspecified practices, while classifying containers. In a broad sense, these standards can be classified into container box standards and container pallet standards. To elaborate, container box standards include 18 physical standards for container boxes and packages with respect to their size, weight, structure and strength. In particular, sea-container standards follow the international standards (i.e., 20 feet and 40 feet containers), while railroad containers use a number of different dimensions. In addition to container boxes, pallets are commonly used in China. Currently, annual pallet transactions in China are estimated to be in the range of 50 to 70 millions. The annual pallet production reaches 20 million. Among newly produced pallets, wooden pallets comprise 90%, plastic 8%, and others 2%, respectively. Due to this diversity, there are 15 different pallet standards including physical dimension standards in China. Currently, 30 different pallet dimensions are used, thus creating material handling difficulties. Although 1200mm series and T-11 type pallets are most popular in China, pallet standards newly refined in 2006 designated both 1200mm×1000mm and 1100mm×1100mm as the Chinese standard pallet dimensions and recommended 1200mm×1000mm as the primary pallet dimension standard.

5.2.2. Transportation Standards. Due to a broad range of transportation activities, transportation standardization rules and policies are developed and administered by multiple government agencies in China. For instance, water transportation standards are set by the Ministry of Transportation Infrastructure Construction, while surface transportation standards are established by the Road Unit of the Ministry of Transportation and the Ministry of Railroads. Other transportation standards related to ICT are set by the Science Technology Unit of the Depatment of Transportation. To elaborate, truck transportation standards regulate the limits of outer dimensions, axle load and masses of trucks which have annual transportation capacity of 8 million TEU, with a total cargo capacity of 70 million ton. Rail transportation standards set by the Ministry of Railroads primarily focused on the use of railroad containers which have varying types and sizes (e.g., one ton, 10 ton, 20 feet, 40 feet, 48-feet, 50-feet) in China. In 2005, half of the railroad containers are one-ton and 5 ton boxes, while 20 feet and 40 feet containers comprised 35%. However, 20-feet and 40-feet containers meeting international standards are increasingly used. Once 18 container handling facilities are built by 2010, all railroad containers will meet international standards. Currently, 755 railroad stations across the China can handle container freight which reached 55.65 million tons, accounting for 2.1% of the total cargo volume in 2005. Among these, 151 railroad stations can handle 40 feet containers, while 341 railraod stations can handle 20 feet containers. Unlike railroad containers which still rely on various dimensions, sea containers use more uniform international standards such as 20-feet or 40-feet containers. This discrepancy may adversely affect the efficiency of intermodal transportation and modal transfer operations (especially between rail and water carriers).

5.2.3. Storage Standards. A pallet standard which played a great role in storage and material handling with the warehouse is in the process of establishing the uniform standard (i.e., 1100mm×1100mm). This pallet standard is also consistent with that of Japan and Korea to facilitate the mechanization and automation of the handling process and eventually speed up storage and handling processes. However, China is still significantly lacking labor safety standards which intend to protect the safety and health of warehousing workers and ensure the uninterrupted operations of storage facilities and equipment. In China, labor safety standards comprise merely 3.7% of all logistics standards. Another cause for concern over storage is the inconsistent standards of yard storage facilities and instrastructure at the Chinese seaports.

5.2.4. Loading/Unloading Standards. Among 18 container loading/unloading equipment, 15 of them follow uniform international standards. As such, some parts of the equipment can be used interchangeably. However, since domestic standards and indexes set by "Tire-style container crane equipment specifications (GB/T 14783- 1993)" are inconsistent with international standards, the Chinese container vessels are often denied for unloading their containers at foreign ports. To make it worse, most of Chinese port authorities have their own standards based on their own needs, thus making the loading/unloading operations of sea containers more challenging.

5.2.5. ICT Standards. Earlier attemps to establish ICT standards in China began with seaports. In the early 80s, both Tenjin and Shanghai ports first introduced computer systems based on the Japanese NEC. Afterwards, other seaports in China followed suit. More recently, the Chinese government accelerated the standardization of logistics information across the industry. For example, all transportation documents follow international documentation code standards. The Ministry of Transportation adopted EDI standards. However, it is reminded that, under the planned economy, the Chinese logistics systems have been managed independently by different regions and Ministries for a long time. As a result, some private enterprises such as as Costco-China and China Shopping developed their own industry EDI standards to exchange data and transmit documents electronically. Likewise, only 15% of the Chinese firms adopted barcode standards for their storage and transportation operations. This kind of practice makes logistics information sharing among the different Chinese enterprises extremely difficult. In addition, most of the Chinese transportation carriers are reluctant to upgrade their basic information systems under the heavy cost pressure.

6. Global Logistics Standardization Trends

As described in earlier sections, both Korea and China cope with serious challenges of standardizing their logistics operations up to international standards. Although each one of the Asia-Pacific countries may have its own unique problems, the Korean and Chinese examples can reflect the typical current challenges facing the Asia-Pacific logistics community. In an effort to help the Asia-Pacific countries expedite the logistics standardization process, we may consider adopting the best practices performed by other countries such as EU nations. Also, considering that ISO standardization principles and guidelines are widely accepted by the international community, we need to examine ISO standardization procedures as a roadmap toward the successful implementation of logistics standardization across the Asia-Pacific countries. The typical ISO standardization procedures start with a suggestion of the areas that need to be standardized through the New work item Proposal (NP). Afterwards, ISO goes through the procedures of developing the Working Draft (WD) and then the Committee Draft (CD). These procedures will be followed by the voting of the proposed drafts by the ISO members. Once the proposal is approved by the voting members of ISO, ISO standards will be finalized in a form of the Draft International Standard (DIS) and the Final Draft International Standards (FDIS).

More specifically, on August 26^{th}, 2003, ISO develop an international pallet standard after it received a majority approval vote (approval 88%, disapproval 12%) from the FDIS. ISO standardized six different sizes of pallets including the T11style 1100×1100, 1200×800, 1200×1000, 1140×1140, 1219×1019, and 1067×1067 pallets. The Euro 1200×800 pallet as shown in Figure 2 has been used prirmarily in Western Europe for 50 years, but was seldom used in other parts of the world as recapitulated in Table 4. In particular, Switzerland, Germany, France, and Sweden have been using either 1200×1000 or 1200×800 dimension as their pallet standards. Unlike Europe, the U.S. primarily has been using the 1219×1016 pallet ever since it was introduced as a standard pallet in the U.S. grocery industry during the 60s and 70s. Despite these ISO-initated standardization efforts, both Korea and Japan seldom use ISO-standardized pallets as compared to Europe and Australia. In particular, Japanese pallet standards may vary depending on the industry. Thus, the Asia-Pacific countries should consider adopting more widely used international pallet standards.

Figure2. The Dimension of the 1200×800 European Pallet Size Standard

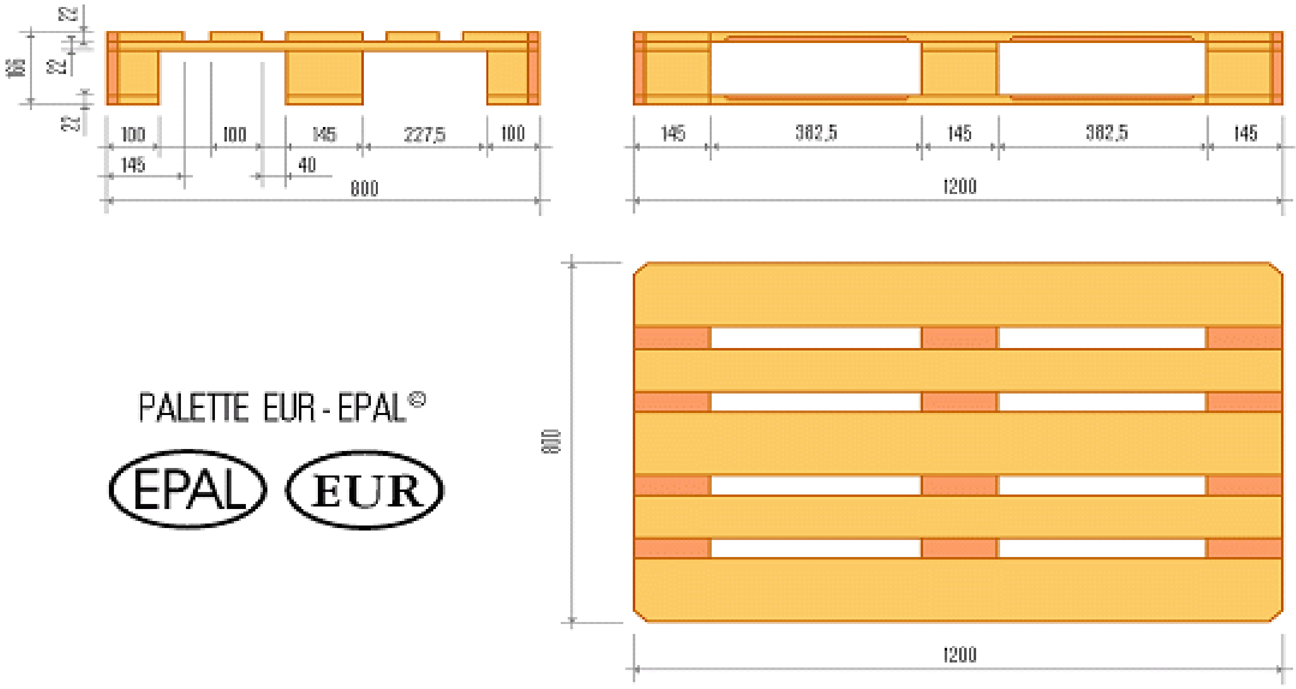


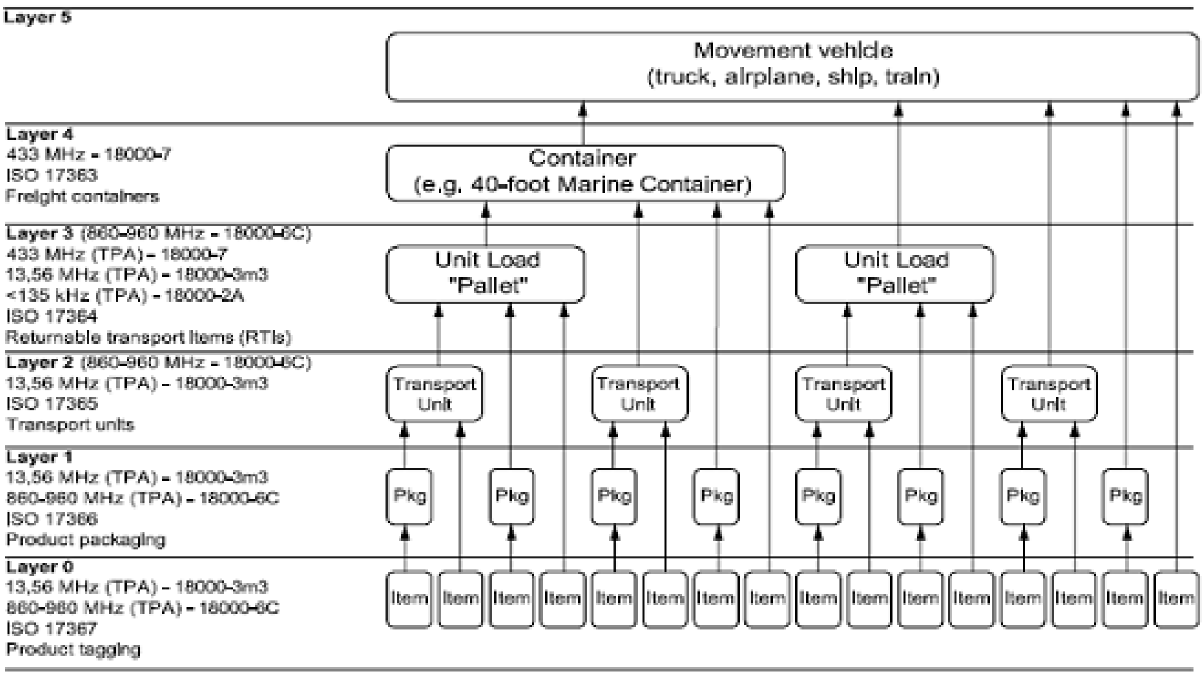
Table 4. The Features of ISO's Key International Pallet Standards

Standard Size	Features	Example
1200×800	● European standard pallet suitable for the European rail transport ● Not useful for sea containers	European countries
1200×1000	● Accepted as a standard by both Netherlands and Germany	Supplement to the European pallet
1140×1140	●Suitable for sea containers	USA, Canada, England
1100×1100	● Widely used in Far-east Asia	Korea, Japan
1219×1016	● U.S. standard, but only used in the U.S.	USA

In 1975, ISO established an intenational packaging size standard and amended it in 1984. According to its rule called ISO 3344:1983, the international packaging standard is 600×400mm (23.62×15.75 inches). ISO 3344 designated rectangular 600×400mm package as a standard package module and then specified standard packages with sizes of 1200×1000, 1200×800, 1200×600, 1200×400, 800×600 and 600×400~1200×100.

In addition to international pallet and packaging standards, ISO took initiatives to develop ICT-related international standards including RFID and EDI. Especially, ISO has been working on the standardization of logistics RFID through the joint workshop on TC 104 (freight container) and TC 122 (smart card RFID application). ISO-initiated RFID standards have five different layers of standards based on RFID tagging applications as shown in Figure 3. Also, the CEN in Europe is making efforts to standardize automatic recognition and data scanning technology and is collaborating with ISO to set RFID standards including the standards of UHF-RFID, RFID with Short Range Devices (SRD) utilizing both LF and HF, and RFID microwave signal equipment. The three European Organizations such as CEN, CENELEC and ETSI have been developing European RFID standards in compliance with privacy, security, intellectual property, and patent rules and then checking to see if their RFID standards are in congruent with international RFID standards. Furthermore, they are making efforts to enhance container security by developing sea and air transportation standards that are consistent with those of U.S., China, Japan, and Korea through continuous cooperation with those countries.

Figure 3. The ISO RFID Standards at Five Logistics Layers



Source: ISO 17683:2007

Another global logistics standardization effort includes the EU's attempt to adopt the Single Administration Document (SAD) system that simplifies various documents necessary for cross-nation freight transportation such as bill of lading, manifest, and driver license as well as the standardization of the Electric Data Interchange (EDI) system that can facilitate the computer-to-computer message transmission and the direct data file transfer among its trading partners.

7. A Summary of Findings and Policy Implications

Despite geographical proximity, Asia-Pacific countries differ significantly in terms of their languages, economic development stages, political systems, life styles, and culture. As such, their logistics standardization levels are different from each other. Based on the current assessment of Asia-Pacific countries' logistics standardization efforts, we found the following facts:

First, the extent of logistics standardization in Asia-Pacific countries (especially Korea, China, Japan, Mongolia) is still limited as compared to U.S. and EU nations. For instance, in China, other than sea container transportation, uniform logistics standards for surface transportation, ICT, labor safety, and sanitary inspection still have not been fully developed and established. Similarly, in Korea, even pallet and package standards are not fully implemented. Another reason for this limited logistics standardization may be the insufficient logistics infrastructure despite construction development booms in the Asia-Pacific countries. In particular, in the cases of Korea and China, it is surprising to find that their logistics infrastructure development was not in parallel with their rapid economic growth. Also, these countries did not seem to recognize the need and importance of logistics standardization and thus were not prepared to embrace logistics standardization until recently. However, with their dependence on international trade, they began to realize that their compliance with international logistics standards directly impacts logistics efficiency and the national competitiveness in the global marketplace.

Second, the awareness of logistics standardization among MNFs in these Asia-Pacific countries does not seem to be high because they seldom suffered from any negative externalities or disincentives for not adopting international logistics standards. This lack of awareness may have something to do with the lack of promotional and enforcement efforts made by the governments. The examples of the promotional efforts include government subsidies and tax exemptions/deductions for both manufacturers and users of standardized logistics equipment, technology, and tools. Also, enforcement rules which can penalize the violators should be developed and implemented further.

Third, unlike the EU regions, there is no regional organization in the Asia-Pacific countries that can actively initiate and unify logistics standardization efforts. Despite the presence of PASC (Pacific Area Standard Congress) in the Asia-Pacific region, it has not taken any initiatives that will bring together Asia-Pacific countries for global logistics standardization. That is to say, the lack of coordinated and concerted efforts among the Asia-Pacific countries made each country's individual logistics standardization efforts less compatible to each other and only increased each government's efforts to impose its own standards on others. To make matters worse, multiple government agencies in the same government tend to get involved in logistics standardization and created inconsistency among them. For example, in Korea, various government agencies such as the Ministry of Construction and Transportation, the Ministry of Maritime, the Ministry of Industrial Resources, the Customs Office, the Public Raildroad Company, and the Inspection Office have been working on the development of logistics standards separately. In addition, multiple committees get involved in the Korean logistics standardization process. These include: the Social Overhead Captial (SOC) presidential committee, logistics policy committee, industrial standard council, and quality control for agricultural products. These duplicated efforts created further confusion. By imitating the EU success, Asia-Pacific countries should actively engage in the international standardization committees such as ISO and their related technical committees such as TC, SC, and WG, while taking a serious look at ISO standards as a foundation for their logistics standardization.

8. Concluding Remarks and Future Research Directions

Given the relatively short history of economic development and late start in moderninzing logistics infrastructure and systems, most of the Asia-Pacific countries face daunting challenges for improving their logistics efficiency. Some of those challenges stem from a lack of compatibility and consistency in their logistics practices which became the major sources of mounting costs and waste. To cope with these challenges, some of the Asia-Pacific countries such as Korea, China and Japan have begun to exert efforts to standardize their logistics operations. These efforts include the development and implementation of both domestic and international standards associated with logistics equipment, tools, packaging, storage, transportation, loading/unloading, and ICT that are compatible with widely-used international logistics standards such as ISO standards. The successful development and implementation of these standards, however, require careful planning and coordination among affected parties such as government entities and private firms in the Asia-Pacific countries. To facilitate logistics standardization planning and coordination among the Asia-Pacific countries, this paper uncovers the sources of difficulties in logistics standardization and then proposes some practical policy guidelines. Although this paper is one of the first to conceptualize logistics standardization and increase the awareness of logistics standardization among the international logistics community, it has several limitations that should be noted. These are:

First, this study relies heavily on the illustrated cases of two Asia-Pacific countries (i.e., Korea and China). As such, the generalization of current findings needs further testing by the further examination of other Asia-Pacific countries such as Japan, Mongolia, and Australia.

Second, due to limited availability of secondary data sources, this study design is geared toward the descriptive study rather than the empirical study. Thus, future research may consider developing some propositions that examine any links between the extent of logistics standardization and the logistics performance at the firm and national level.

Third, considering the potential impact of national culture on logistics practices, cross-cultural studies that can compare and contrast logistics standardization efforts of both Asia-Pacific countries in the high context culture and European/North American countries in the low context culture are worth pursuing.

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References

Besen, S.M. and Farrell, J. (1992), "Choosing how to compete: Strategies and tactics in standardization," *Journal of Economic Perspectives*, Vol. 8, No. 2, pp. 117-131.

Blind, K. (2004), *The Economics of Standards: Theory, Evidence, Policy*, Northampton, MA: Edward Elgar Publishing, Inc.

Evangelista, P. and Sweeney, E. (2006), "Technology usage in the supply chain: the case of small 3PLs," *The International Journal of Logistics Management*, Vol. 17, No. 1, pp. 55-74.

Fabbe-Costes, N., Jahre, M., and Rouquet (2006), "Interacting standards: A basic element in logistics networks," *International Journal of Physical Distribution and Logistics Management*, Vol. 36, No. 2, pp. 93-111.

Formin, V., Keil, T., and Lyytinen, K. (2003), "Theorizing about standardization: Integrating fragments of processs theory in light of telecommunication standardization wars," *Sprouts: Working papers on Information Environments, Systems and Organizations*, Vol. 3, No. 1, pp. 29-60.

Garud, R., Jain, S. and Kumaraswamy, A. (2002), "Institutional Entrepreneurship in the sponsporing of common technological standards: The case of Sun Microsystems and Java," *Academy of Management Journal*, Vol. 45, pp. 196-214.

Manrodt, K.B. and Vitasek, K. (2004), "Global process standardization: A case study," *Journal of Business Logistics*, Vol. 25, No. 1, pp. 1-23.

Ojala, L. (2010), "On logistics costs and competitiveness," Presented at the PREM Trade Logistics and Facilitation Day, May 6, World Bank.

Perego, A., Perotti, S., and Mangiaracina, R. (2011), "ICT for logistics and freight transportation: a literature review and research agenda," *International Journal of Physical Distribution and Logistics Management*, Vol. 41, No. 5, pp. 457-483.

Schilling, M.A. (1998), "Technological lockout: An intergrative model of the economic and strategic factors driving technological success and failure," *Academy of Management Review*, Vol. 23, No. 2, pp. 267-284.

Youngjun time (2009), "Automotive logistics China's emerging standards," June 15, http://www.youngjun-logistics.com/BD_EN/Logistics_Knowledge_view.aspx?id=84, retrieved on August 8, 2011.