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STANDARDS EDUCATION FOR YOUTH

– Digital coursebook

KATS Korean Agency for Technology and Standards

KSA KOREAN STANDARDS ASSOCIATION

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What is a Standard?

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01 Standards and standardization in daily life

Our daily lives are closely linked to standards. Standards are involved even in simple everyday tasks such as looking at a clock or crossing a crosswalk.

a. A clock face - The part of an analogue clock displaying time through the use of a flat dial numbered 1 through 12 indicating the hours in a 12-hour cycle.

b. Toothbrushes/toothpaste - Keeping teeth clean without causing damage to the gums.

c. Passenger cars/buses/subway trains - Standard products manufactured through standardized manufacturing processes.

d. Traffic signals rules - Set representation of red lights (stop), yellow lights (caution) and green lights (proceed).

e. Rules for sports including soccer/basketball/baseball games

f. Working standards - Standards used in working processes.

g. Korean Industrial Standards - Standards for personal protective equipment, mechanical pencils, mechanical pencil leads, etc.

h. Relationships between family members - Standards based on the traditional cultural background of society.

02 Definitions of a standard and standardization

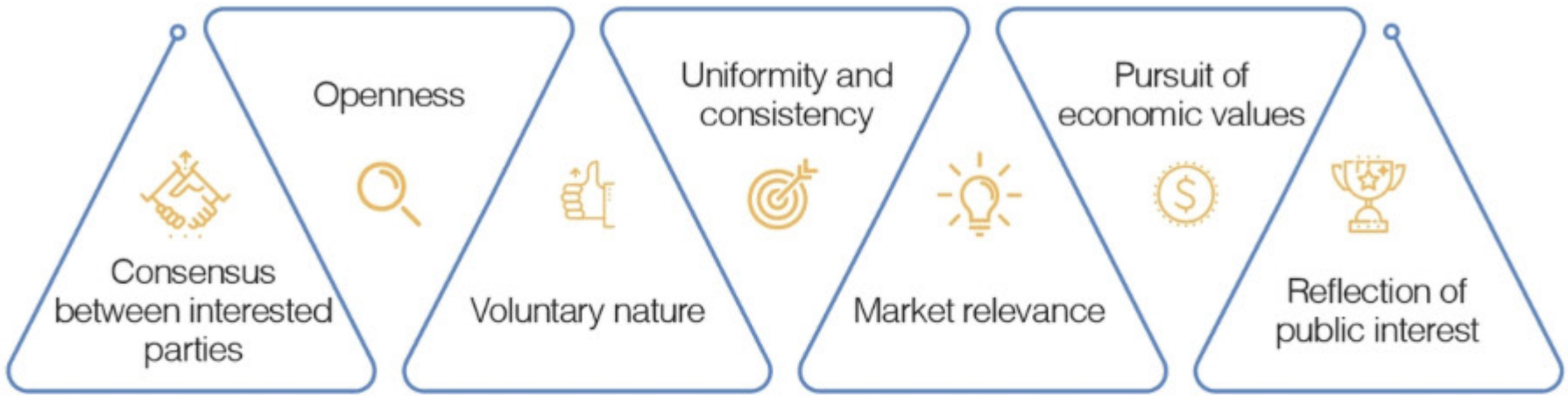
The term standard in the Korean dictionary refers to "the basis, criteria, and goals for making a measurement, reference or judgment." However, the term standard used here is different from the above definition from the Korean dictionary. The definitions of a standard given by each organization are as follows:

Reference	Definition of standard
ISO/IEC Guide 2:2004	document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context **Note 1 to entry:** Standards should be based on the consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits.
WTO/TBT Agreement (2001)	Document approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for products or related processes and production methods, with which compliance is not mandatory. It may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method. **Explanatory note:** The terms as defined in ISO/IEC Guide 2 cover products, processes and services. This Agreement deals only with technical regulations, standards and conformity assessment procedures related to products or processes and production methods. Standards as defined by ISO/IEC Guide 2 may be mandatory or voluntary. For the purpose of this Agreement standards are defined as voluntary and technical regulations as mandatory documents. Standards prepared by the international standardization community are based on consensus. This Agreement covers also documents that are not based on consensus.

Standardization refers to an organized activity that sets reasonable standards for objects, concepts, methods, and procedures, and creates rules, guidelines, and guides to follow and utilize such standards. As with the term standard, each organization gives its definition of standardization as follows:

Reference	Definition of standardization
ISO/IEC Guide 2:2004	activity of establishing, with regard to actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context **Note 1 to entry:** Important benefits of standardization are improvement of the suitability of products, processes and services for their intended purposes, prevention of barriers to trade and facilitation of technological cooperation. **Note 2 to entry:** In particular, the activity consists of the processes of formulating, issuing and implementing standards.
Oxford dictionary	the process of making objects or activities of the same type have the same features or qualities; the process of making something standard

03 Principles for the development of standards



04 Differences between standards and patents

The concept of patents is easy to confuse with standards. However, there are many differences between standards and patents. First, while the purpose of standards is to share technologies, that of patents is to privatize technologies.

Classification	Standards	Patents
Purpose	Sharing of technologies	Privatization of technologies
Focus	Social expansion of innovative technologies	Recognition of exclusive rights of inventors who develop innovative technologies
Effects	Social distribution and use of technologies	Encouragement of the development of innovative technologies

05 Effects of standardization

Standardization plays a variety of roles in our daily lives. Let's think about how the following advantages of standardization help us in our daily lives:

a. Simplification of products and business activities and improvement of interchangeability

Paper sizes like A4 have been standardized, which allows us to use paper in set sizes anywhere in the world and use printers and copiers more conveniently since they have also been standardized to be compatible with paper.

b. Smooth communication (mutual understanding) between all interested parties

Even when people of different cultural backgrounds or languages work together, communication between them becomes smooth if the working rules or methods are set as standards.

c. Pursuit of overall economic feasibility

Battery sizes have been standardized across Korea and o]tries, so that Korean batteries can be exported to various countries across the world.

d. Safety, health, environmental, and life protection

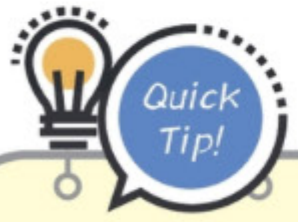
Standardizing the specifications and intensi]s of safety equipment such as seat belts and helmets makes it possible to ensure user safety even in dangerous situations.

e. Protection of the interests of consumers and workers

Standardizing the methods or procedures for after-sales services allows consumers to conveniently receive follow-up warranties after purchasing goods.

f. Contributing to field and office automation

Just as the standardization of automobile parts allowed the mass production of automobiles by machines, various work-related tasks can become more convenient if standards are applied to working rules or methods.



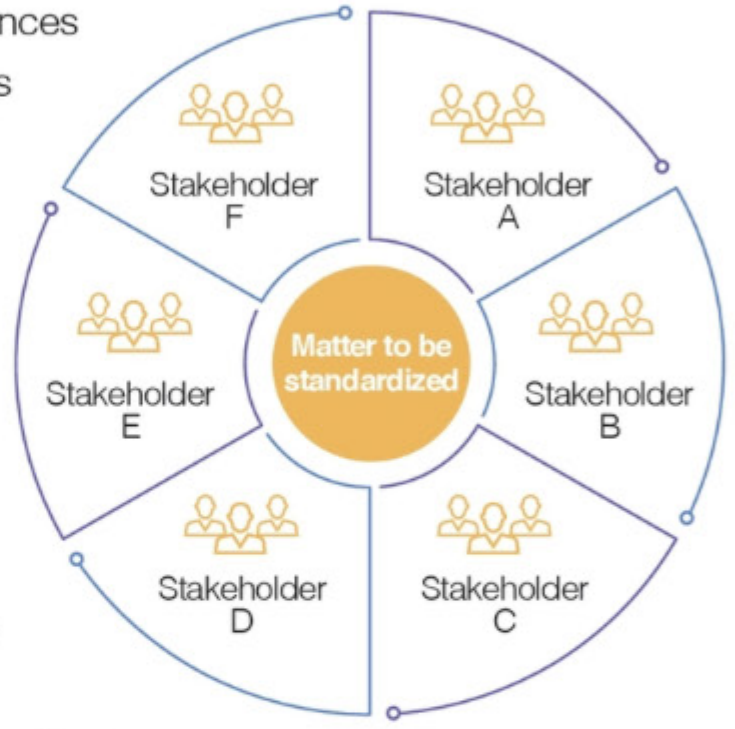
"Standards" are promises and rules that we make in modern society to live a more comfortable, safer, and more prosperous life, and the act of making and using such standards is called "standardization."

We all observe, use, and benefit from standards in our lives, even without knowing.

More to Read

Characteristics of standards

Standards are established to eliminate inconveniences and enhance convenience and reliability in things that are used commonly and repetitively by many people. Standards are sometimes misunderstood to undermine diversity as they pursue uniformity by nature.



However, standards seek uniformity and simplification in accordance with the most reasonable criteria, and do not infringe upon diversity through unconditional unification. Standards develop from the conflict between uniformity and diversity.

These characteristics of standards will make it easier to understand the essence of standards. First, standards are voluntary and market-oriented. Various interested parties can participate in standardization processes and present their opinions on the matter, which means that standards are developed based on market needs.

Next, standards are based on consensus. All standards go through a process of discussions between interested parties to reach overall consensus. After resolving conflicts through the dialogue process, standards are finally approved through an official voting process.

Finally, public standards are determined by the approval of an authorized agency. This means that standard documents are approved by ISO, IEC or a national standardization body, and that the relevant standards go through a public consultation process.

Standards have a significant influence on our lives, though we may not be aware of it. Standards stipulate the specifications, shapes and capacities of products, processes and systems, and also specify the performance of products or human resources. Standards define specific terms in order to prevent mistakes in the use of such standards. Standards provide a variety of values to numerous interested parties.

II

Roles and Effects of Standards

Changes in the awareness of standards

Roles of standards

Effects of standardization

Importance of standardization

01 Changes in the awareness of standards

a. Time-dependent changes in standards

Classification	1960s-1990s: Labor- and capital-intensive industrialization age		2000s to the present: Technology- and knowledge-intensive information age
Basic	National standards		International standards
Roles	Interchangeability, convenience, mass- production, quality assurance	⇒	Elimination of technical barriers to trade (TBTs), creation of market-dominant demand
Format	Paper format		Online format

b. Changes in standards per industrial revolution

Classification	First Industrial Revolution (mechanical revolution)	Second Industrial Revolution (energy revolution)	Third Industrial Revolution (digital revolution)	Fourth Industrial Revolution (technology convergence revolution)
Timeline	Late 19th century	Early 20th century	Since the 1970s	Since 2020
Main driver of innovation	Steam engine	Conveyor belts	The Internet and mobile devices	Convergence between technologies and industries
Production method	Mechanized factory production	Mass production	Digitalization, automation	Hyperconvergence, hyperconnectivity, superintelligence
	↕	↕	↕	↕
Standardization standpoint	Focused on basic standards including dimensions and shapes	Focused on standards for quality control including products, parts, and processes	Focused on protocols and interchangeability standards	Focused on standards for system and interface convergence

02 Roles of standards

a. Improving mutual understanding	b. Fine- tuning diversity	c. Ensuring interchangeability	d. Ensuring conformity with the purpose of use	e. Protecting user and consumer interests
Setting standards for means of communication improves mutual understanding.	Standards reduce social chaos and prevent confusion.	Standards enhance productivity and applications by increasing mutual interchangeability between tangible objects.	Standards guarantee consumers a certain level of quality or performance that satisfies their needs, and ensure that producers can set their own production and supply objectives as well as guarantee methods.	Standards can ensure benefits to both producers and consumers, while ensuring safety and protecting the environment in the case of a conflict between the two sides.

03 Effects of standardization

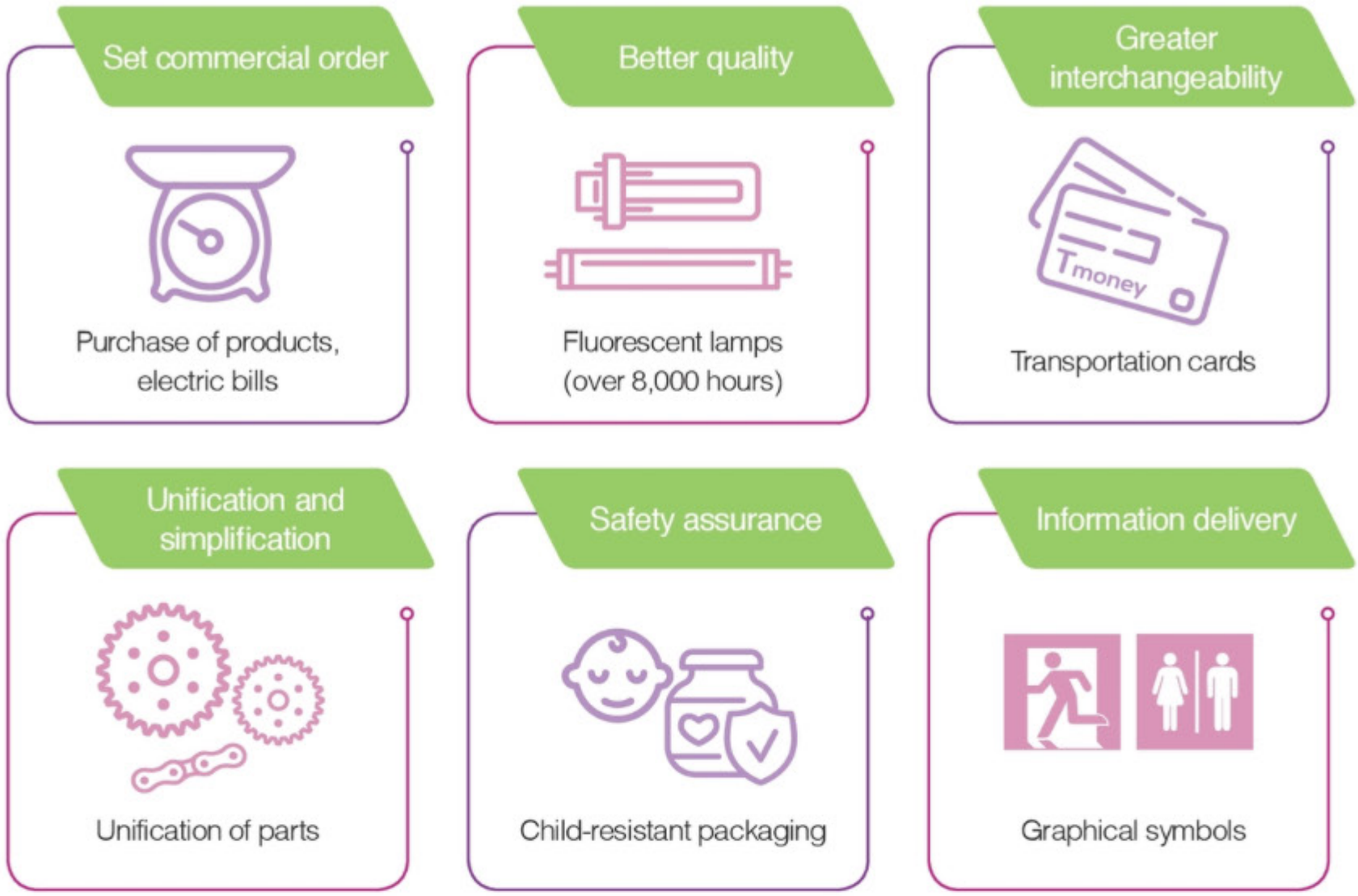
a. Positive effects

1) Network externalities caused by interchangeability
   - When standards ensure the compatibility of a product with others, the utility of the product increases as the number of its users increases.
   - Standards raise returns on investment.

2) Economies of scale and promotion of the development of new technologies
   - Standardization enables economies of scale and accelerates sales competition, thereby facilitating the development of new technologies. This leads to an increase in sales.

3) Reductions in production and learning costs
   - Standards reduce the trial-and-error process and prevent recurring problems, thereby decreasing production and learning costs. 4) Reductions in search and measurement costs
   - Standardization reduces the search and measurement costs of market transactions as more information is made available.

5) Characteristics of standardization as a public good
   - Standardization improves convenience in daily life and enriches our lives.



[Positive effects of standards]

b. Negative effects

1) Interruption of the introduction of the latest technologies

- Standardization may impede the reflection of the latest technologies and the rapid application of new scientific technologies. 2) Reduction in diversity
- Standardization can cause some consumers to suffer the disadvantage of having to use products manufactured using relatively expensive technologies.
- Standards for generally inferior technologies are likely to dominate industries due to hesitation toward developing new technologies that are difficult to make compatible with existing technologies.
- Standardization incurs standards development costs, product modification costs to meet standards, and product performance test costs for certification tests.

3) Slowdown in technical innovation

- Technologically underdeveloped countries may become dependent on more advanced countries.
- Standardization leads to divisions between technologically advanced and underdeveloped countries.
- Companies that are disqualified from international standardization processes sustain economic losses.
- Standardization may incur excessive loyalties.

4) Decrease in employment

- Technical innovation such as the automation of factory production facilities can diminish human roles and subsequently decrease employment.

04 Importance of standardization

a. Domination of international standards in advance

With the rise of regional hegemonies such as the EU and NAFTA, the world has entered an era of infinite competition. This means that dominating international standards in advance can create a competitive edge.

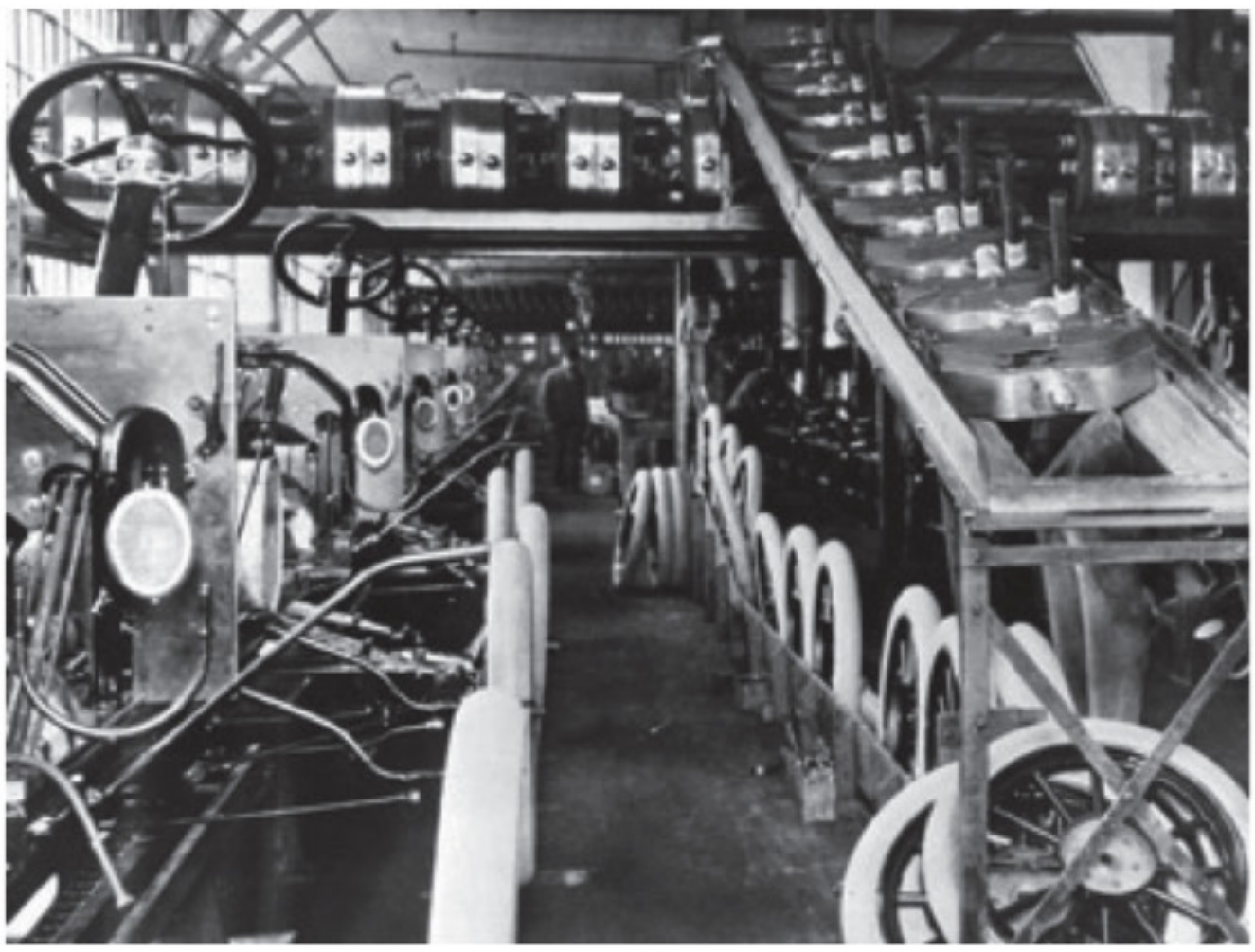
b. Elimination of TBTs

Standardization can lower TBTs. Standardization facilitates trade between countries by lowering TBTs, which hinder the free movement of goods between trading partners as they adopt and apply different technical regulations (technical rules, standards, and conformity assessment procedures).

More to Read

History of standardization

The first known case of artificial standardization in human history was the invention of a measurement unit for mass, which was used in Egypt around 7,000 BC, and a stone cylinder that was created in a standardized form at the time has been handed down to the present day. In the East, one of the first achievements of Emperor Qin Shi Huang after unifying China was the standardization of weights and measures. Throughout history, the state established and used standards to pursue fairness and convenience in tax collection while ensuring the fairness of private commercial transactions, which serve as the foundation of the national economy. Standards have grown further with the development of human society and technological advances, leading to the numerous key effects of standardization.



<The conveyor belt system first installed by Ford Motor Company in 1913>

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The first effect is the use of standard parts. The Dutch in the 17th century developed a production method that allowed fishing boats to be built in a dramatically short period of time by setting the number of replaceable parts and modularizing (or standardizing) these parts before manufacturing the boats. This enabled the Netherlands to emerge as the world's premier shipbuilding country and maritime power at the time, and the Dutch experience later reached the U.S., which utilized similar methods to an even greater result. Eli Whitney (1765-1825), known as the father of standardization, standardized all parts for firearms and developed the concept of the mass production of interchangeable parts based on the use of machine tools. This concept was invented to resolve shortcomings such as the excessive time required to manufacture military rifles as they were each made by hand in the past, and that it was impossible to repair a rifle immediately even when only a single part was broken or faulty. This method was heralded as a technology that achieved a breakthrough transition through the use of standard parts. Using this technology, Whitney succeeded in winning the largest purchase order from the U.S. government on record at the time in 1804.

In addition, standardization began to be applied not only to products but also to manufacturing processes, a trend led by Henry Ford (1863–1947), who was dubbed the king of the automobile industry.

Ford deviated from the batch production method, whereby a working group composed of skilled workers and apprentices produced cars, and invented a method of improving productivity by subdividing all automobile manufacturing processes and standardizing every stage of the respective processes in order to immediately implement such methods at production sites.

This allowed Ford Motor Company to gain the highest competitive advantage while paying the highest wages at the time. Thanks to the standardization of products and production processes, the industrialized society of the 20th century was able to mass-produce high-quality and uniform products.

Since then, the development of standards and standardization has been further accelerated. In 1995, Bill Gates (1955–) succeeded in networking the global markets by standardizing Microsoft' s Windows operating systems. Gates was already aware of the importance of standards due to his experience of industrial standardization. Although the web browser Netscape Navigator had already dominated the market

at the time based on its functional advantages, Microsoft's Internet Explorer then overtook Navigator by capitalizing upon its standardized compatibility with IBM systems. This was partly due to Microsoft's aggressive business tactics that even saw it committing illegal acts at times, but even such illegal acts can be seen as a tactical ploy used to gain a dominant position in terms of standards.

III

Stories of Standards in Daily life

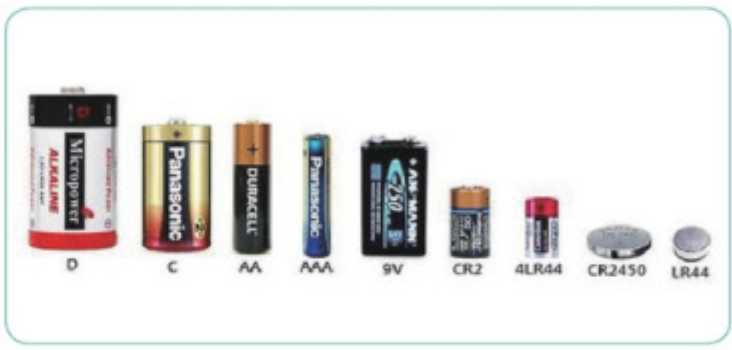
Standards in daily life

Importance of standards

01 Standards in daily life

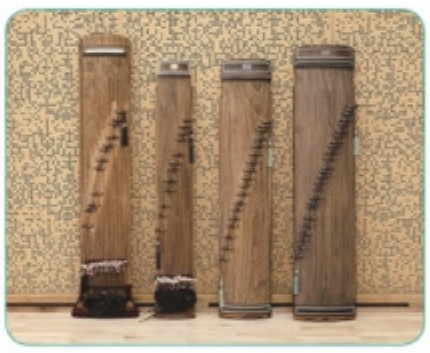
a. Convenient standards to ensure uniform shapes or sizes

e.g.) A4 paper, fuel filler caps, batteries, clothing sizes, etc.



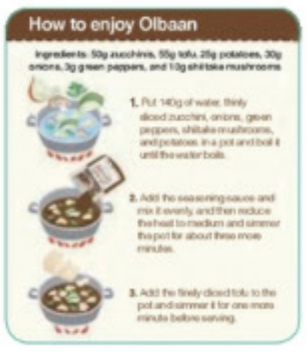
b. Convenient standards to pre-set places or orders

e.g.) Traffic lights, computer keyboards, piano keyboards, strings of the Korean traditional musical instrument gayageum, etc.



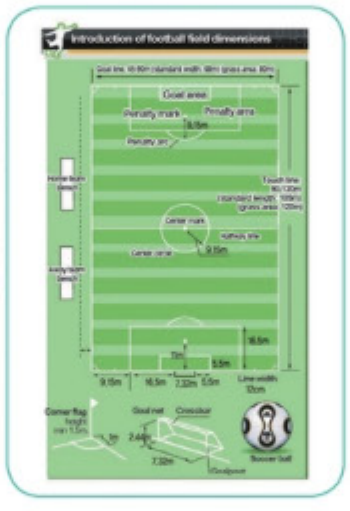
c. Standards enabling anyone to use new technologies

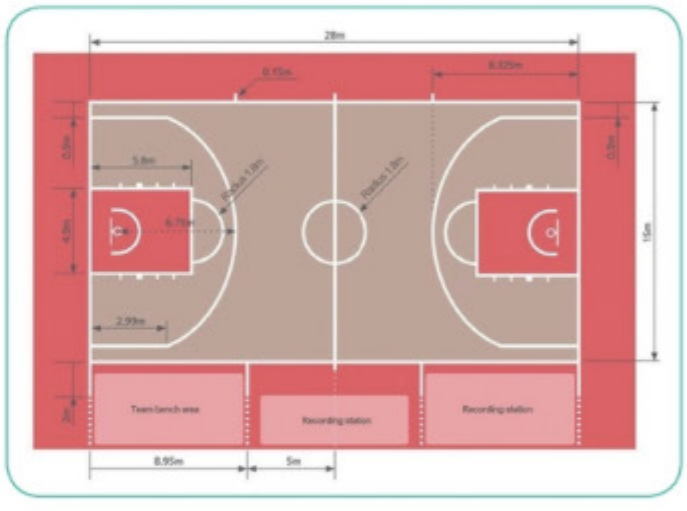
e.g.) 5G, smartphones, newly developed vaccines, food recipes, etc.



d. Orderly standards to establish habits or cultural norms

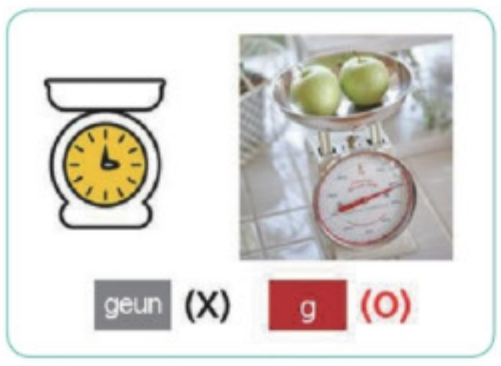
e.g.) Keep to the right, sports rules and regulations, etc.





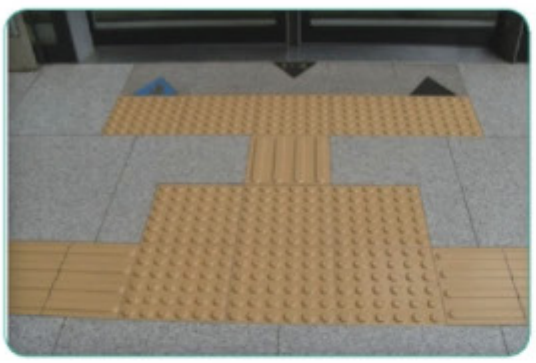
e. Easy-to-understand standards with predefined names and symbols

e.g.) The metric system, pictograms, names of colors, etc.



f. Standards for the convenience of the elderly, disabled, and infirm

e.g.) Braille blocks;; logos for the elderly, persons with disabilities, pregnant women, etc.



02 Importance of standards

What would the world be like without standards? Let's look into the importance of standards through the following examples.

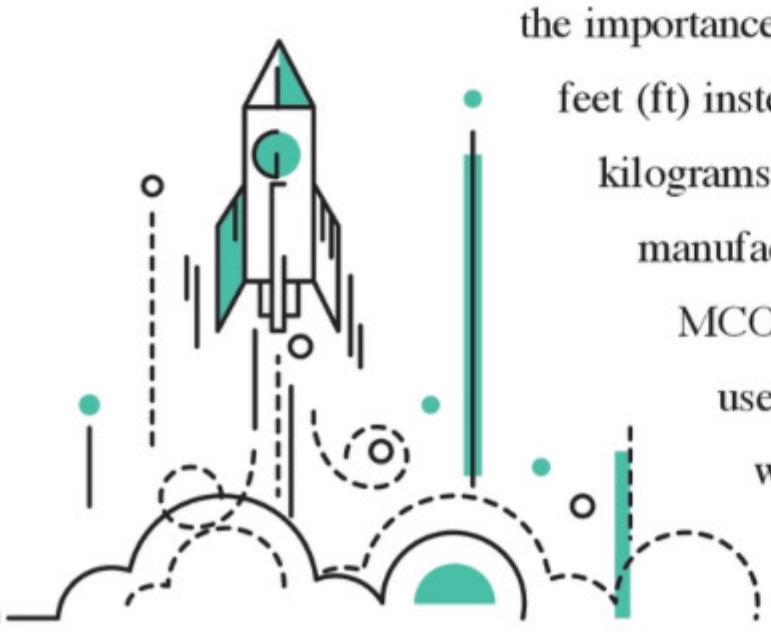
Case 1

Failed satellite launch due to a mix-up of mathematical units

In the early morning of September 23, 1999, researchers at the National Aeronautics and Space Administration (NASA) in the U.S. were in a busy flurry of activity. At 1:41 a.m., the "Mars Climate Orbiter (MCO)" folded its solar panels to enter Mars' orbit and began to control its altitude. Everything seemed to be going well. The satellite was then expected to lose communication with Earth for a moment as it entered orbit behind Mars.

However, its signals cut out 49 seconds earlier than scheduled and the satellite was lost forever. NASA had spent three years and USD 600 million (about KRW 658.3 billion) to develop the MCO and the project went unfulfilled before the MCO was able to conduct any investigation of Mars at all.

The cause of the failure was revealed two days later. The thrust that drove the spacecraft should have been calibrated in newtons (N), a metric measure of force, but the MCO had been calibrated in pounds (lbs.) instead. One pound of force is equal to about 4.45 newtons. It was a fatal mistake in spaceflight, where even a minor margin of error could yield disastrous results. The disappearance of the MCO is a notable example of the importance of unifying units. The U.S. and the U.K. use feet (ft) instead of meters (m) and pounds (lbs.) instead of kilograms (kg). At the time, Lockheed Martin, an arms manufacturer responsible for analyzing data from the MCO flight, was using lbs. and ft, while NASA used kg and m for the MCO mission. The tragedy was caused by someone's failure to convert the pound figures sent by Lockheed Martin into



newtons first.

Another disaster caused by miscalculated units was the case of the space shuttle Challenger that occurred on January 28, 1986, when the space shuttle exploded only 73 seconds into its flight. At the time, NASA announced that the failure of the rubber O-rings in a joint on one of the two solid booster rockets led to a leakage of combustion gases, which tore the shuttle apart. All other parts were made in meters, but the two O-rings were made in inches instead and failed to fully seal the joint due to minor errors arising from numerical differences between parts.

※ Source: A Chosun Ilbo article dated April 25, 2015

Case 2

An airplane crash caused by confusion over measurement units

On July 23, 1983, an Air Canada Boeing 767 was en route from Montreal to Edmonton with 69 passengers and crew members on board. The plane was a brand-new model that had only recently been released. Midway through the flight, the aircraft's engine warning light came on, indicating a fuel shortage, and the airplane eventually ran out of fuel and the left-side engine stopped at an altitude of 40,000 feet.

<The emergency landing site of the Air Canada Boeing 767>

While the jet was descending to attempt an emergency landing, the right-side engine also stopped at 20,000 feet, leaving the aircraft in a desperate situation. If the aviation fuel had been correctly calculated in the SI unit, the plane would have been refueled with 20,088 liters of fuel. However, since the fuel volume had been calculated in pounds instead of kilograms, the plane had only been supplied with 4,916 liters of fuel. As the jet had a reserve of 7,682 liters of fuel on board at the time, and therefore, carried a total of 12,598 liters (about 10,116 kilograms) of fuel even after refueling. Since the Fuel Quantity Information System Processor that was supposed to automatically calculate the amount of fuel had failed to function as designed, the maintenance crew manually entered a fuel load of 22,300 kilograms into the onboard computer. However, the actual amount of jet fuel on board was merely 45% of the required fuel load.

As a result, the pilots decided to make an emergency landing at a former Royal Canadian Air Force base in Gimli, Manitoba, which had already been shut down and later converted into a motor racing track for the local sports car enthusiast club. Fortunately, the airfield was empty at the time as a racing event had just ended. The 767 eventually touched down at the former airbase and began braking at full power. Two tires on the landing gear blew out, and since the nose gear had not fully locked, the 767 ran onto the tarmac with the nose grazing the ground and barely came to a stop only hundreds of feet away from the tail end of the runway.

The captain testified that there were two children on bicycles approximately 1,000 feet (304.8 meters) ahead of the plane, so close that he could see their petrified faces as they fled. Thankfully, no one was injured on the runway, including the two boys on bikes, and none of the 61 passengers were injured or killed.

※ Source: Wikipedia and Travie

More to Read

Graphical symbols (Pictograms) – Providing information through graphical composition!

Emergency exit (left hand)

Provision for the disabled or handicapped persons

Toilets – Unisex

Restaurant

When delivering important information, long sentences and complex words often fail to attract attention in a timely manner.

Moreover, when the information concerns locations or tools that are needed in the case of emergencies or the explicit prohibition of a certain subject, the message should be clear so that anyone can understand it.

Student Kim Hyeon-gi (age 24) told us what happened when he tried to explain bathroom signs to foreign friends.

"There are a lot of different bathroom signs in Korea. The bathroom at a tourist destination was marked with a sign depicting a man wearing gat, a traditional Korean hat for men, and a woman wearing jokduri, a bride's headpiece for a traditional Korean wedding, and my friends mistook the bathroom for a souvenir shop. One friend thought that the women's bathroom was off limits, because the sign showed a red silhouette of a woman."

Officer worker Kang Yun-hui (age 34) described a similar experience. "A bathroom sign at a ski resort that opened last year looked like it was a sign for a ski rental shop. I remember wandering around elsewhere to look for a bathroom. People of various ages and foreigners visit the resort, so why isn't there a simpler sign? I would have been even more confused if I had

been abroad facing the same situation."

These signs that we are familiar with in our daily lives are called pictograms. The term pictogram is a compound word combining picture and telegram, and pictograms were created to deliver information quickly through an image. Pictograms used in various fields from public facilities to Olympic sports must be easily understood and utilized by anyone regardless of language, ethnicity, culture, religion, habits, gender, and age.

In the past, numerous signs created in in developed countries were used without permission in Korea or contained uniquely Korean imagery that made them difficult for international usage. In 2004, the Korean government sought to resolve this issue by reorganizing the public information symbols into KS A 0901 standards and instructing government agencies to begin actively using them. (In 2015, KS A 0901 was revised as KS S ISO7010 adopting ISO 7010:2011.)

Prohibition (red), caution (yellow), subway (yellow), and emergency exit (green) signs present information on the use of colors, and encompass non-smoking signs or information signs such as public bathhouses and zoos. In addition, eight types of safety signs used in Korea were adopted in the ISO international standards in May 2005.

With the recent adoption of the Asian face shape proposed by Korea as the "standard face model of the ISO safety signs," face protection signs including the Asian face shape replaced the Caucasian Western face protection signs that were originally established in Germany and had been used over the past 30 years. Similarly, there is a dangerous dog sign that has the shape of the head of the native Korean Jindo breed of dogs. Do you think we might be safer on our travels or in everyday life if the signs that we see when traveling abroad or going through our daily lives are more familiar to us?

※ Source: Korean Government Briefing dated April 16, 2005

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IV

Fourth Industrial Revolution Era and Standards

Big data

Internet of Things

3D printing

Smart wearable devices

Autonomous driving technology

Smart factories

Smart cities

01 Big data

Big data refers to the technology of generating, collecting, storing, managing and analyzing data to extract value and facilitate smart services. Big data technology provides important information that enables more accurate predictions and insights and greater efficiency across all areas of society as well as our everyday lives. In addition, big data makes it possible to provide customized information to each individual, thereby offering a technical infrastructure that allows mass customization industries.

Big data technology can be largely divided into big data platform operation technology, such as data collection, storage, and processing, and big data analysis and utilization technology designed to create new insights and business value by processing big data through big data analysis/prediction technology to ensure that it can be utilized or by visualizing the analyzed data.

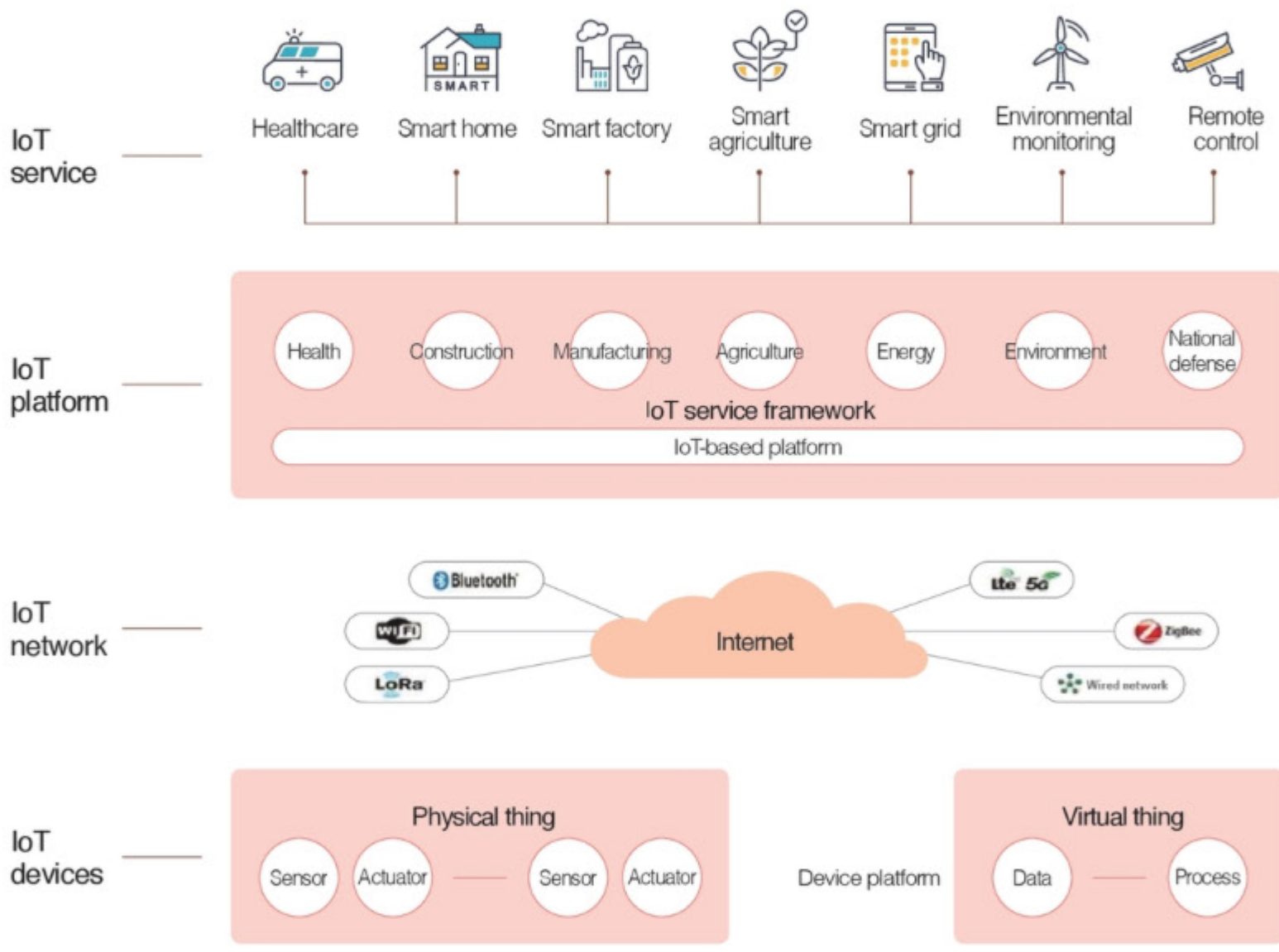
Standardization items for big data include “underlying technology” for big data itself, “distribution technology” for data exchanges between different organizations, “management technology” in terms of metadata and data management, and “privacy/security technology” for personal information and security. Korea’s response to the field of big data also includes devising standardization strategies for each technology area.

Variety	+	Velocity	+	Volume	+	Value
Various forms of data		Rapid speed of data generation		Collective term for the aggregation of large-scale data, related technologies, and personnel		The meaning of big data is expanding in terms of analysis value and utilization effects

[Characteristics of big data]

02 IoT

The Internet of Things (IoT) refers to convergence and integration technology that connects various objects, spaces, and people through the Internet and provides intelligent services autonomously by analyzing, predicting, and judging situations. It is an infrastructure technology that offers autonomous convergence services through interactions and intelligence suitable for any situation, any time and any place.



※ Source: Korean Ministry of Land, Infrastructure and Transport

[IoT configuration map]

In recent years, billions of devices have become connected in a wide range of areas, such as the public sector, services, and industries, as well as among individuals, and therefore, IoT is expected to create new services that have never been seen before.

The standardization of IoT has been carried out in the following six categories: "IoT service technology" through convergence with existing information and communications technology (ICT);; "IoT platform

technology" for interworking between different IoT platforms;; "IoT network technology" for low-power IoT device-based communications, network management, etc.;; "IoT device technology" centering around smart sensors and smart dust;; "IoT security technology" including integrated security framework technology, blockchain-based IoT authentication framework, etc.;; and "smart farms" based on IoT technology.

※ Source: 2021 Business Plan of ISO/IEC JTC 1/SC 41 (SC41N1764)

[IoT SDOs and Alliances Landscape – Vertical and horizontal domains]

03 3D printing

3D printing refers to a new manufacturing technology that uses three-dimensional model data to create a three-dimensional object by building up layers of materials in powder, liquid, solid or any other form. 3D printing can not only manufacture products that are difficult or impossible to manufacture by conventional manufacturing processes due to various factors such as porosity, complex structures, biomimicry, and individualized products, but can also be applied to production sites for general products. The main advantages of 3D printing include a reduction in production costs and time spent for producing prototypes, small-quantity batch production, and simplification of the manufacturing process.

When replacing a used grip,
it takes a long time to break it in.

By scanning the used grip using a 3D printer, the same grip as the old one can be printed.

Printing a customized grip
=
Able to focus on training without the process of breaking in the new grip

※ Source: Huemone Lab

[Example of 3D printing technology applied in archery bow-making]

As the global 3D printing market has grown rapidly, Korea has also been dedicating growing efforts on standardization activities with a view to raising its competitiveness. At present, only data formats or protocols have been published as ISO international standards, while there are varying product standards among major 3D printing companies in countries such as Germany and the U.S. Since international standards are not yet led by specific countries and companies, Korea still has the potential to play a leading role in the field through technological advancements.

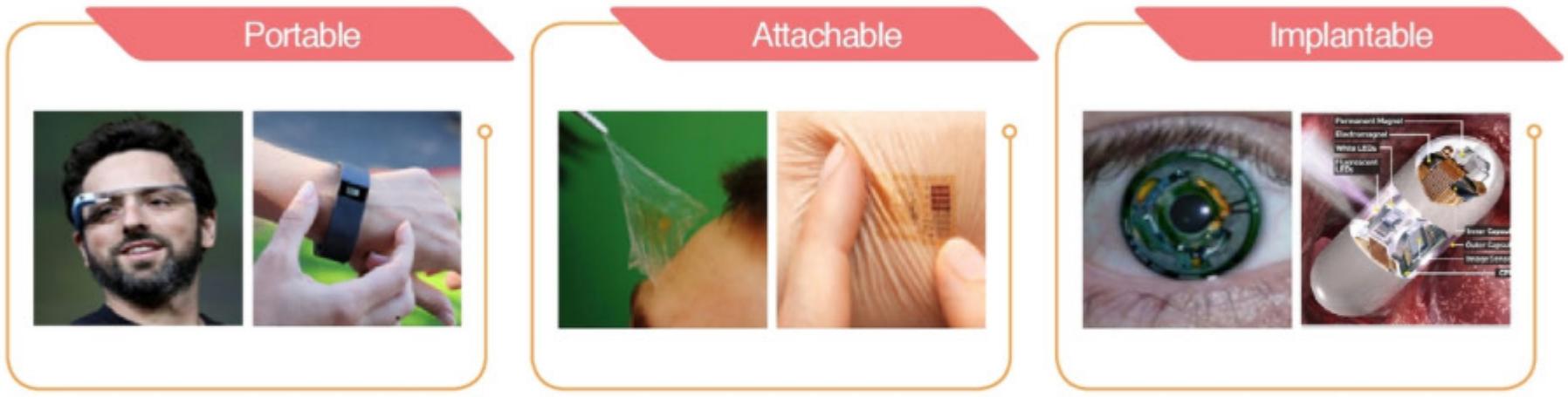
04 Smart wearable devices

"Smart wearable devices" refer to electronic devices that can be worn. Such electronic devices are not simply designed to be worn on a user's body, but also to communicate with the user at closest proximity to the user's body.

One of the advantages of smart wearable devices is that they can continuously collect detailed information

of their surrounding environment or changes in the user's body to provide real- time responses. Smart wearable devices are already being used for various purposes such as healthcare, life care, industries, national defense, clothing/fashion, and games and sports using AR/VR. In healthcare, a field where such devices are commonly used, a variety of data such as the user's body temperature, blood pressure, blood sugar, heart rate, electrocardiogram, and other biological data, as well as physical activity, are measured and used for health and fitness purposes.

Wearable devices are products that can be easily carried like smart phones. Such devices can be classified into the following three types: portable devices that can be carried in the forms of glasses, watches or bracelets (bands) that have been released to date, attachable devices that can be directly attached to the skin like bandages, and implantable devices that can be directly implanted or ingested into the body, which can be viewed as the final stage of wearable devices.



[Development of wearable devices in line with technological advancements]

Standards related to wearable technologies vary depending on the functions and types of parts. The international standardization of wearables remains centered around the software level, while the differentiation and variation of the types and characteristics of wearable devices in the future is expected to expand standardization to include the network and hardware levels as well.

05 Autonomous driving technology

The term autonomous vehicle refers to a vehicle that can drive itself without manual operation by its driver or passenger (Article 2 of the Motor Vehicle Management Act). Achieving fully autonomous driving services will require highly reliable real-time system technologies such as the recognition and judgment of the driving environment, vehicle control, map/positioning, human interface, communications/security, etc., while related intelligent semiconductors and low-power high-performance computing systems are also becoming increasingly important.

In particular, beyond simply providing means of transportation, autonomous vehicles are expected to create new services that are linked to conventional transportation systems or unmanned vehicles. These new services may include support for the transportation disadvantaged as well as mobility, logistics, emergency transportation, etc. in areas with poor public transit access.

Human ····· System

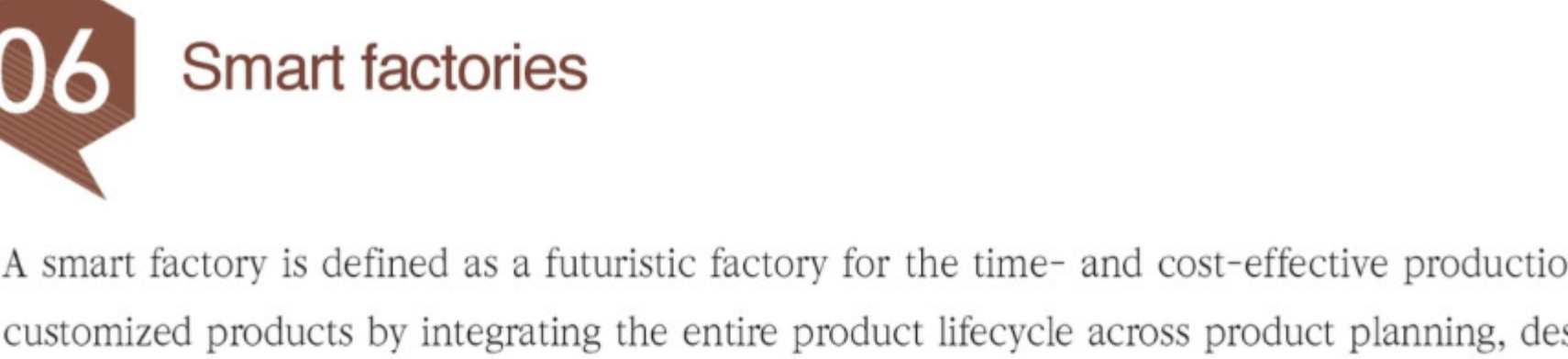
	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
Definition	No driving automation	Driver assistance	Partial driving automation	Conditional driving automation	High driving automation	Full driving automation
Content	A human driver is responsible for all driving tasks (includes warning systems).	A human driver is responsible for driving (steering or accelerating/ de celerating is assisted).	A human driver is responsible for driving (both steering and accelerating/ dece lerating are automated).	A human driver is responsible for driving, but only in certain conditions (the driver must be ready to take control at any time).	The vehicle is considered fully autonomous on certain routes.	The car is able to operate itself under all driving conditions.

[Technological stages and scopes of autonomous vehicles]

The autonomous driving system detects driving conditions using sensors, communication systems and other devices installed in a vehicle, and if risks are identified, the system controls the vehicle or sends a warning message. Various systems, performance requirements, test procedures, and other elements that are required in such cases have been standardized.

06 Smart factories

A smart factory is defined as a futuristic factory for the time- and cost-effective production of customized products by integrating the entire product lifecycle across product planning, design, production, distribution, and services through data-processing technology. The smart factory is a consumer-centric intelligent factory that moves beyond conventional factory automation. Smart factories modularize each process, which makes it possible to produce a variety of customized products in an organic and active manner based on consumer preferences in a single production line. Moreover, unlike conventional factories, smart factories manage and control sites and quality in real time through virtual spaces, etc. and improve efficiency in terms of the utilization of resources such as energy and human resources, which may eventually improve product competitiveness by lowering production costs.



[Definition of a smart factory]

The need for the standardization of smart factories can be divided into the following aspects: improving the competitiveness in terms of international standards, enhancing the competitiveness of small and medium-sized enterprises (SMEs), and guaranteeing people's happiness and safety.

Firstly, if advanced countries such as Germany and the U.S. dominate the relevant standards, they may be used as a trade barrier and it is therefore necessary to improve competitiveness in

international standards by actively engaging in the development of technological standards for smart factories and international standardization activities.

Secondly, in order to enhance the competitiveness of SMEs, there is a need for common standards that improve the connection of various devices and objects in factories and integrate networking.

Finally, the establishment of a flexible manufacturing service system based on standards allows people with creative ideas to come up with new services and start their own businesses.

07 Smart cities

A smart city is defined as a new model of sustainable cities that can solve various urban problems and improve urban competitiveness and quality of life. It refers to a state in which physical urban facilities can provide efficient urban services by integrating advanced ICT such as IoT, big data, and AI.

Organization (term)	Definition
ISO (Smart city)	city that increases the pace at which it provides social, economic and environmental sustainability outcomes and responds to challenges such as climate change, rapid population growth, and political and economic instability by fundamentally improving how it engages society, applies collaborative leadership methods, works across disciplines and city systems, and uses data (3.1)information (3.2) and modern technologies to deliver better services and quality of life to those in the city (residents, businesses, visitors), now and for the foreseeable future, without unfair disadvantage of others or degradation of the natural environment Note 1 to entry: A smart city also faces the challenge of respecting planetary boundaries and taking into account the limitations these boundaries impose. Note 2 to entry: There are numerous definitions of a smart city; however, the definition that is used within TC 268 is the official one agreed to by the ISO/IEC Technical Management Board.
ITU (Smart sustainable city)	A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental, as well as cultural aspects. NOTE – City competitiveness refers to policies, institutions, strategies and processes that determine the city's sustainable productivity.

[Definitions of smart city in SDOs]

The expected effects of smart city standardization can be divided into the following aspects: improving competitiveness in international standards, enhancing the competitiveness of SMEs, and guaranteeing people's happiness and safety.

Firstly, Korea is expected to spearhead international standardization based on domestic smart city maturity models, push forward the international standardization of the Smart City Integrated Platform technology, promote the international standardization of technological standards through systemic industry-research-government cooperation, and enhance national competitiveness.

Secondly, such standardization aims to create an environment for corporate investment through the government's preemptive support for the establishment of key smart city infrastructure, build basic infrastructure, and then encourage its private sector usage, thereby reducing the burden and uncertainty of private investment, with the aim to build an environment for the creation of various services.

Lastly, in terms of guaranteeing people's happiness and safety, the standardization intends to expand smart city solutions that closely affect residents to existing cities and aging downtown areas, and embody a virtualized digital twin-based smart city by linking real-space data to spatial information. Through such efforts, Korea is expected to establish a public safety net that can respond to disasters and manage facilities, and lay the foundation for balanced national development through the spread of smart cities.

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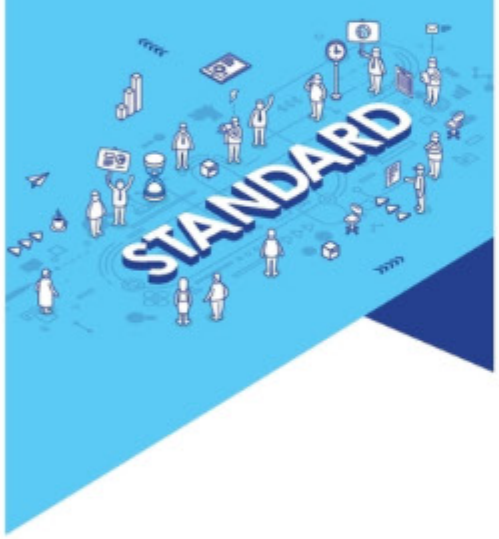

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