The Process of the Metric System's Acceptance in Korea and Its International Context

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In July 2007, the Republic of Korea finally pushed forward the exclusive usage of the metric system, prohibiting the customary use of *pyeong*, the Japanese unit of area, and *geun* and *don*, Korean traditional weight units. The Gabo Reform (1894) was the first overall reform of the metrology system, and in 1902, the metric system was introduced in Korea, adjusting the traditional base units of *cheok*, *seung*, and *nyang* to meter-based scales. As the influence of the Japanese colonizers increased, weights and measures gradually resembled those used in Meiji Japan. In 1926, the metric system was adopted as the legal metrology. Nevertheless, customary weights and measures were still allowed "for the time being" in everyday life. Such a compromise continued after liberation, even after the introduction of the Measurement Law in 1961.

The reasons the Korean government adopted the metric system seem to be the general trend of international society and the export-oriented tactics of the Korean economy, rather than a demand by civil society. Thus, while the government has made an incessant effort to adopt the metric system for nearly a century, the related laws have not been efficiently executed. The use of customary weights and measures was not completely eradicated until 2007 even though their use was outlawed in 1961. This prolonged process of accepting the metric system seems to be the result of a lack of public discussion and social consensus on the metrology system.

Keywords: weights and measures, metric system, legal metrology, modernization, internationalism, global standard

Introduction

The metric system, a product of the French Revolution, has brought about a greater change than a mere political revolution in our daily life. The weights and

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measures that were varied and unfixed according to the regions and objects to be measured were changed into a rational system that was unified, fixed, coherent, and natural.

Political ideals of the French Revolution pursued universal human rights, that is, freedom and equality of all human beings. In reality, however, through the Napoleonic Wars, they detonated the nationalism of other states, finally resulting in generating an inter-national system constructed of a number of nation-states, instead of single human society. Afterwards, through the two World Wars in the twentieth century, the global governance beyond the balance of power has been groped for but its realization seems to be far away. However, nowadays SI (*Système international d'units*), the enlarged metric system, has become the global standard of measurement for most countries in the world. Most countries have adopted the metric system as legal metrology and even the FPS system of the United Kingdom and the United States has been arranged as a meter-based scale since World War II.[1] For the first time, the metric system has made the measurements of our daily life correspond with the units of scientific measurement and enabled factory mass production, global capitalism, and modern scientific and technological civilization.

In 1902, Korea first introduced the metric system in the form of adjusting the traditional units of *cheok* (尺, length), *seung* (升, volume), and *nyang* (兩, weight) to meter-based scales. In 1926, during the colonial period, the metric system was adopted as legal metrology. However, as it was hard to change customs all of a sudden, the combined use of customary weights and measures was allowed for the time being in everyday life. Since liberation, the Republic of Korea has pushed forward the exclusive usage of metric in everyday life and commercial trade, and finally prohibited the use of the last remnant of Japan's unit of area, *pyeong* (坪), and customary weight units, *geun* (斤) and *don*, in July 2007. Throughout this process, the government was very eager to adopt the metric system, though it was not the result of social consensus. The element to accelerate the acceptance of the metric system was not so much the demand or consensus of civil society as the general international trend and the export-oriented tactics of the Korean economy. Of course, this aspect was different from that of France, home of the metric system, and those of the United Kingdom and

1. The FPS system is composed of foot (length), pound (weight or mass), and second (time) as its base units and inch and yard as other linear units. After World War II, it was adjusted to the metric system by rounding the inch down to 25.4*mm* (Hebra 2003: ix).

the United States whose discussion on the adoption of the metric system was active but whose governments were very passive in its introduction.

Few studies have been done on the process of accepting the metric system in Korea, much less of the 1902 and 1905 laws of Daehan jeguk (Great Korean Empire) and the 1926 laws and regulations of Chosensōtokufu (Japanese Government-General of Colonial Korea). This study reveals the process of the acceptance of the metric system and considers some characteristics and implications of the process.

"Disorder" of Weights and Measures in the Late Joseon Dynasty

In East Asia, including Korea, weights and measures have been traditionally called *do-ryang-hyeong*. *Do* (度), *ryang* (量), and *hyeong* (衡) indicate length, volume, and weight, respectively; *cheok*, *seung*, and *nyang* are the names of their units as well as physical rules and vessels. During the Meiji period in Japan, in contrast with the metric system, the traditional system was named *shaku-kan* system (尺貫法). The historical records on weights and measures of premodern Korea paid the most attention to "disorder" and to the correction or reform of the system. The survey results that Japan had made during the colonial period in relation to Korean weights and measures seemed to imply that there was a lot of disorder in the metrology system. The extreme disorder was shown in the units of dry measure for grains (See Figure 1). When setting the Japanese

Figure 1 Korean Traditional Dry Measure, *mal*
(Tongyeong, 1895, 26.4x26.4x12.7*cm* ≒7,303 cm^3)

Source: Gukrib minsok bakmulgwan 1997:81.

volume unit *shō* (升) as a standard, the measure varied depending on the district or county in Gyeongsang Province. Korean *seung* (升), or *doe*, was changed from 0.86 Japanese *shō* in Sancheong to 2.69 *shō* in Goseong; Korean *du*, (斗) or *mal*, from 2.24 *shō* in Yeongcheon to 5.46 *shō* in Sangju. Inconsistent as they were found to be, 1 *du* ought to be 10 *seung* legally but, unbelievably, *seung* in Yeongcheon was much more than *du* in Goseong according to the investigations (Lee 2004:70).

A serious problem was the use of a wrong-sized vessel or the faking of the scale's division. The fraudulent measurement by merchants was a big problem in private commercial dealings, and the fraudulent measurement by lower officials became all the more painful to ordinary people when taxes were paid in kind. The basic problem was that of the multiplicity and diversity of weights and measures. Since long ago, centralized states have been established in China and Korea, and weights and measures was one of the essential concerns of premodern states. However, before modern times, there were various measures that were not standardized. Legally, the base unit in length was cheok which derived from ancient China and belonged to a decimal scale of 10 *ri* = 1 *bun*, 10 *bun* = 1 *chon*, 10 *chon* = 1 *cheok*, and 10 *cheok* = 1 *jang* with *ri* (釐) as a minimum unit. However, in everyday life a variety of measures that couldn't be easily calculated in terms of the *cheok* system were used altogether, such as units stemming from the human body like the *gil* equivalent to the height of an adult and the *bal* equivalent to the length of one's arms outstretched, and the units showing geographical distance like *bo* (5-6 *cheok*) equivalent to a step or *ri* (里) being much longer than *bo*.

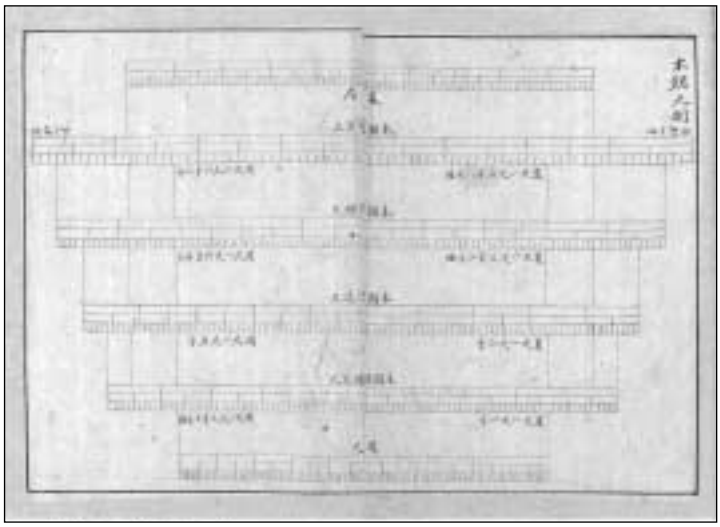
Moreover, in spite of the same unit, the size was different according to the measured objects or the region. In the basic code of the Joseon dynasty, *Gyeonggukdaejeon* (Grand Code of Managing the Nation), there are regulations of five kinds of *cheok* according to the objects to be measured: *ju-cheok* for land surveying; *hwangjong-cheok*, the length of a tube sounding a particular tone called *hwangjong; yeongjo-cheok* for construction work; *joryegi-cheok* for manufacturing sacrificial vessels; and *pobaek-cheok* for measuring cloth (Table 1). The standard was *hwangjong-cheok* and the longest *pobaek-cheok* was more than double the length of *ju-cheok*. Seo Myeong-eung wrote Siakhwaseong doryanghyeongbo bonjocheokje (詩樂和聲度量衡譜本朝尺制) in 1790 and it shows the length of the five kinds of *cheok* (Figure 2). The top is the standard of comparison, the Chinese *ha-cheok* (25.7*cm*), and in order, there are 0.8 *pobaek-cheok* (36.15*cm*), 1 *hwangjong-cheok* (30.7*cm*), 1 *yeongjo-cheok* (30.7*cm*), 1

Table 1 Regulation on the Size of Five Kinds of *Cheok* Shown in *Gyeonggukdaejeon*

	ju-cheok	***hwangjong-cheok***	***yeongjo-cheok***	***joryegi-cheok***	***pobaek-cheok***
hwangjong-cheok	0.660	1	0.899	0.823	1.348

Source: Hanguk jeonsin munhwa yeonguweon 1985:485

Figure 2 Comparison of the Length of Five *Cheok* in the Late Eighteenth Century



Source: Gukrib minsok bakmulgwan 1997:43

joryegi-cheok (28.05*cm*), and 1 *ju-cheok* (20.45*cm*).

Part of the units constituted a decimal scale, though not completely. Legally, the weight of water which filled a *hwangjong* tube was decided as 88 *bun*, and the weight units were classified as follows: 10 *ri* = 1 *bun;* 10 *bun* = 1 *jeon;* and 10 *jeon* = 1 *nyang*. However, the most popular and convenient weight unit, *geun*, was regulated as 16 *nyang*. It was extended according to an incoherent scale as *daeching* (100 *geun*), *jungching* (30 or 7 *geun*), and *soching* (3 or 1 *geun*).

Also, it was difficult to manufacture invariable physical prototypes unsusceptible to the changes of environment. In spite of a periodic correction of weights and measures, standards became obscure. China, Korea, and Japan all followed the *cheok* system but the size of *cheok* was different in each country. Moreover, the measures that were used in everyday life such as rulers and receptacles

copied and recopied the prototypes that were made by the central government and the real size of a unit showed little difference according to the time and place even in the same country.[2] Gonjo, or the Ministry of Industry and Construction of the central government, took charge of the production and supply of copied measures. However, as even the privately copied measures could be used after the inspection and certification of the government, disorder and confusion in using measures became more serious.

Nevertheless, such a state of "disorder" was not unique to Korea. In fact, it was not so much a simple disorder as another order and justice governing the premodern world. There appeared diversity and apparent disorder of measures as the units of measurement were closely connected with the objects being measured, and the concept of abstract and absolute quantity and its measurement irrelevant to everyday life wasn't necessary. In the premodern age when the differences of status, sex, and region were distinct, it was impossible to take a population census enumerating all people equivalently as "one" and even consider the concept of population itself. Equally, before the establishment of a national market, national economy and market prices, it was order and justice not that 1 *geun* should always have the same weight but that 1 *geun* of beef, 1 *geun* of fruit, or 1 *geun* of vegetable should have different weights respectively.[3] Under the moral economy that governed the premodern age, 'just price' was not a price fixed by a nationwide uniform law of demand and supply and paid in single currency but the price suitable to customs of local communities, the concrete need of an individual customer, and socially accepted humaneness. "In short, the old diversity of weights and measures, far from being irrational and unnatural, formed the backbone of the Ancient Régime economy" (Alder 2002:134). This explanation is applicable to premodern Korea.

Considering there were frequent incorrect measurements, it shows that correct and precise measurements in actual business trade didn't matter very much. Traditionally, business trade was not about selling a fixed quantity at a fixed

2. The comparatively less variable *yeongjo-cheok* and *ju-cheok* became a little shorter in their standard size at the beginning of the latter half of the Joseon dynasty. But *pobaek-cheok*, connected with collecting taxes, became improper to a considerable degree and its standard size became longer during this time (Lee 2004:62).
3. After the metric system was introduced and declared as legal and exclusive metrology, the weight unit *geun* was widely used in Korea. One *geun* of beef is equivalent to 600*g*, 1 *geun* of fruit is 400*g*, and 1 *geun* of vegetable is 200*g*.

price, but the parties concerned decided the price through bargaining and negotiation. When measuring grain by *doe* (*seung*) or *mal* (*du*), both *pyeongdu* and *gobong* were used. *Pyeongdu* was used to level the vessel off with the grain whereas *gobong* was used to heap the grain high in the vessel. It was a habitual business practice in premodern times to give more than the fixed quantity "for good measure." Among the cases of lower officials who were accused of collecting taxes over the fixed quantity, there were many cases that were not caused merely by an individual vice. As the bulk of grain decreased when dry, they were forced to collect more than the fixed quantity in the county to meet the requirements of the central government (Ha 1987:119).

The standard of order and justice in such a world was not rational calculation but the justice and habitual practice of reciprocity. The calculative rationality that we can consider nowadays only remained in the official documents of the state in premodern times. As was shown in *hwangjong-cheok*, which was related to musical instruments for ritual ceremony, the units that were strictly regulated in the code were ritual ones that were not used in everyday life. On the contrary, the size of the volume units *seung* and *du*, which were very important in the economy, was not regulated correctly in the code. As was typical in most civilizations, even in East Asia, weights and measures were the symbol of law, order, and justice.[4] Accordingly, every king made an effort to correct the *cheok* system, which showed the will of good governing and administration not to speak of the improvement of the measurement itself.

Though premodern society was managed according to its own order, justice, and rationality which are different from those of today, the shift to modern times was an irrevocable historical trend. The modern capitalism that emerged from the West began to win the whole world over to a single system, and East Asia was forcibly included in the system in the latter half of the nineteenth century. Until then, the Joseon dynasty had tried to push forward modernization in its own way. Since the opening of Korea's ports, Western modern civilization was wholly accepted in Korea and the speed and breadth of modernization became uncontrollable.

4. Saying that the symbol of justice in China was weight while it was balance in the West, Park Yeong-cheol discussed the difference of the concept of justice between China and the West (Park 1999).

Invention and Worldwide Spread of the Metric System

Most of the premodern societies, including Korea, had the same task of nation-state building and the unification of language, money, and weights and measures within their own territory. There were two possible ways relating to metrology reform. One was to aim for the unification and rationalization of a measurement system throughout the country while keeping and adopting the names and sizes as standards that were connected with the capital or royal family or most widely used among traditional customary weights and measures. The reformed *shaku-kan* system during the Meiji period and the FPS system of the United Kingdom and the United States are good examples. The other was to introduce a completely new rational system like the metric system of France.

During the revolutionary period, France introduced an entirely new unit, meter (*metre*), instead of the linear unit *aune* or *toise* that was commonly used in Paris. It was not based on the size of a human body or a particular thing like many traditional units but a unit drawn from measuring the exact size of the earth according to a new idea concerning nature and human reason after the scientific revolutions. That is, 1 meter was defined as 1/10,000,000 of the length of the quarter meridian (from the North Pole to the Equator). And to measure the exact length of the quarter meridian, two French scientists, P.F. André Méchain and J.B. Joseph Delambre, took seven years to measure the distance from Dunkirk to Barcelona beginning in 1792. As were all decisive changes, there were a lot of scientific knowledge and institutional infrastructures that were necessary to the meridianal definition of the meter before the Revolution, but some parts of the change were impossible without the momentum of revolution and republicanism.

The characteristic differences between the metric system and previous weights and measures were as follows. First, the metric system was based on nature. Though the size of a foot or the length of a finger could be a measure of nature, the metric system was founded on the only invariable standard of the exact size of the earth. Second, while the FPS system has complicated relations between units like 1 foot = 12 inches, 1 yard = 3 feet in length, and 1 ounce = 16 drams, and 1 pound = 16 ounces in weight, the metric system wholly followed the decimal scale. Third, simple and systematic relations were established among length, volume, and mass (weight). Area and volume were represented according to linear units (*m*) like square (m^2) and cube (m^3). Traditional weights were replaced by mass, whose unit the kilogram was defined as the mass of

water of a specific volume at a specific temperature. These relations were extended to the concepts of newly developed pure and applied physics like velocity, acceleration, pressure, density, and concentration, as well as traditional weights and measures. Fourth, to express decimal submultiples and multiples of the base unit, Greek prefixes like *milli-*, *centi-*, *deci-*, *deca-*, *hecta-*, and *kilo-* were attached instead of denominating each of them separately, which ensured standardization.[5]

It was maintained that the metric system was universal as it was purely rational and it belonged to "all the people of all times" (*à tous les temps, à tous les peoples*) since it was founded on the size of the earth (Cox 1958:359). It was also the instrument of both everyday life and science. As *Germinal* or *Thermidor* was extraneous to a specific place or person's name, so the name *metre* derived from the Greek *metron*, signifying measurement. In the premodern age, the nobility and landowners changed the size of weights and measures arbitrarily and their names and sizes were different according to province. Now, the meter was maintained to be a natural and republican measure and the only measurement system of enlightened humanity. This argument was considered rational and logical, but on the other hand, such an argument could leave a typical ethnocentric impression on other countries. Moreover, it was during the 1790s that the metric system was devised and established. In 1789, the French Revolution occurred and in 1793, Louis XVI was executed. France was at war with most of the European countries and Napoleon was emerging as a man of influence. Of the two scientists who had gone on the measuring expedition to determine the length of a meter, Delambre was mistaken for a counterrevolutionary or an enemy spy in northern France in the midst of the revolutionary war and Méchain took measurements in the enemy states Spain and Italy during the war.

However, extraneous to the war, European communities of scientists and intellectuals (*savants*) were interested in the metric system and began to organize international cooperation. It was the Paris Academy that devised and pushed forward the metric system at first. In the midst of the Revolution, this academy was abolished and some members were purged. The Institute of France

5. To review the propriety of these arguments is beyond the scope of this study. For the propriety and correctness of the meridian measurement, refer to Alder 2002; for the strength and weakness of the decimal system, Hebra 2003 and Heilbron 1990; for the relation between the metric system and French nationalism, Alder 1995 and 2002.

was established in 1795 and the budget consuming project on the metric system continued. In the same year, the National Convention which wanted to enforce the new metrology appropriate to republicanism together with a new calendar and new currency introduced "provisional meter" based on the established size of the earth and fixed the basic names of meter, liter, gram, etc. In November 1798, the measurement of Delambre and Méchain was completed and the results were presented at an international conference called by the French government.[6] In 1799, based on the conference, the first prototypes of meter and kilogram were made.

At first, the diffusion of the metric system was unsatisfactory even within France, let alone the European countries that were at war with France. People didn't benefit from the metric system that was created ostensibly in their interest. Unlike the expectation of the exclusive use of the meter system at first, the imperial government contrarily abandoned to hold on to the decimal system in 1812. With the collapse of the Empire of Napoleon, the use of the meter system disappeared almost completely. The alteration of weights and measures was more difficult than political revolution or currency reform (Heilbron 1990:236-8). However, to form the central bureaucracy and national economy of a modern country, a rational metrology that was unrelated to the feudal legacy was essential in other countries as well as in France. On January 1, 1840, the French government again made it a duty to use the metric system. In the late 1840s, the Netherlands, Belgium, Switzerland, Spain and Italy, who had adopted the metric system in addition to France, came to exchange opinions and search for cooperation to standardize the measurement system.

Another element to propel the acceptance of the metric system was international cooperation, especially in the areas of science and technology, in the latter half of the nineteenth century. The international cooperation of scientific activities that began with correspondence across the borders among the scholars of the Enlightenment took on the form of an international congress at that time (Crawford 1992:38). With the increase of international exchanges among scientists, a common language, common symbols, common standards of observation and experiment and, above all, common metrology were needed. Broadly speaking, owing to the development of transportation and communication that were represented by railway, telegraph and the Suez Canal, it was the period that

6. This congress is considered the first international scientific conference (Crosland 1969).

dreamt of peaceful internationalism based on the results of the Industrial Revolution, at least within Europe. The preoccupation of technology and standards would not lead to enormous wealth or severe competition among countries so much as would be widely expected to be a resource for all humanity. Accordingly, Esperanto, devised by Zamenhof as an international artificial language that was not based on an existing specific country or nation, was attempted and the unification of European currency was also pushed forward. It was a period of great international exhibitions and the modern Olympic movement and also the period that shared the standards of census and official statistics Adolph Quetlet had suggested.

At the first great international exhibition in London in 1851, the judges found the greatest difficulty from the different weights and measures used by different countries. With this as momentum, the demand for an international metrological system increased. Afterwards, up to the 1870s, many international scientific congresses and conferences including several international exhibitions and the International Statistical Congress had an interest in the metric system, and some intellectuals of the United Kingdom and the United States joined in the metric movements. At the turn of the 1860s, a number of Latin American countries adopted the metric system and the International Postal Congress recommended international usage of the metric system for postage purposes. In 1867, the International Geodetic Association stressed the importance of a unified system of weights and measures in Europe and recommended the creation of a permanent bureau to construct new metric standards. In an effort by the French government not to lose its hegemony of the metric system, the International Meter Commission had been held since 1870. At last, on May 20, 1875, seventeen countries signed the diplomatic treaty known as *Metre Convention* and established the International Bureau of Weights and Measures (BIPM: *Bureau International des Poids et Measures*). Together with BIPM, the General Conference on Weights and Measures (CGPM: *Conférence Générale des Poids et Measures*) and the International Committee for Weights and Measures (CIPM: *Comité International des Poids et Mesures*) were established (Cox 1958; http://www.bipm.org).

In 1874 and 1889, BIPM manufactured many sets of prototypes for the meter and kilogram made of platinum-iridium alloy (Alliage de 1874) and distributed them to member nations. Afterwards, the metric system became more delicate according to pure and allied physics and the meter was defined not by physical standards but by other methods. In 1960, the 11th CGPM redefined the meter as

Figure 3 First Standards *(étalons*) of the Meter (right) and the Kilogram (left)

Source:http://www.bipm.org/en/convention/wmd/2004/history.html

1,650,763.73 times the wavelength of the orange-red light emitted by the radioactive isotope krypton-86. The 17th CGPM redefined the meter as exactly "the length of the path traveled by light in a vacuum during a time interval of 1/299,792,458 of a second" (Hebra 2003:34).

Meter-Based *Cheok-Gwan* System in Korea since the Gabo Reform and the Japanese Influence

In the systematic reform bills of Gungukgimucheo (Central Bureau of Military and National Affairs), the center of reform administration established by the Gabo Reform in 1894, the reform of currency and weights and measures was contained. The business of weights and measures that Gongjo took charge of in the past was transferred to Gongsangguk (Bureau of Industry and Commerce) of the newly established Nongsangamun (Ministry of Agriculture and Commerce). As of October 1 of the same year, Naemuamun (Ministry of the Interior) had a *sinsik* (reformed) regulation of weights and measures proclaimed (Gwanbo, June 28, 1984 and July 11, 1984). However, as were a considerable number of reform projects at that time, it was probable that this metrology reform bill wasn't put into practice and the sizes of reformed prototypes were unknown. Meanwhile, Nongsangamun and its successor Nongsanggongbu took charge of the business of weights and measures continuously and Pyeongsiseo that had taken charge of the business of weights and measures in Seoul in the past was abolished.

Korea's weights and measures at this time were still in disorder. On December 10, 1896, an editorial in *Dokrip sinmun* criticized that the disorder of

Korea's weights and measures was an obstacle to internal transactions and foreign trade and demanded that the system of weights and measures should be unified and the production, repair, and sales of rulers and receptacles should be strictly regulated. It is remarkable that this editorial regarded the private production of weights and measures as an illegal one, like counterfeiting private currency, and urged not the introduction of a new metrology system but the unification of units within the *cheok-seung-nyang* system. Perhaps it is assumed that the device of the Gabo officials for metrology reform wasn't far from it. However, the subsequent metrology reform in Korea met a new phase like the unification into Japanese units and the acceptance of the metric system. The Japanese influence that was being strengthened gradually was a decisive factor.

In Japan, the diversity and disorder of weights and measures, especially that of linear units, caused by feudalism was serious. After the Meiji Restoration, the Japanese modern *shaku-kan* system that regulated *kanezyaku* (曲尺) as a new base unit of length was implemented. In 1875, the 8th year of Meiji, it was proclaimed in the name of the Ordinance for Control and Inspection over Weights and Measures. Afterwards, Japan joined the Meter Convention in 1886 to comply with the trend that the metric system was spreading globally and proclaimed a law on a new metrology system re-regulating *shaku*, i.e., *kanezyaku* as a metric-based unit in 1891 (24th year of Meiji). While this law regulated *shaku* and *kan* as base units of length and weight respectively, it suggested the bar and weight made of platinum-iridium alloy, in other words, the prototype of meter and kilogram, as physical standards. Accordingly, 1 *shaku* and 1 *kan* were no longer decided by the length of the *hwangzong* tube or the weight of water filled in it. Instead, they were regulated as 10/33 of 1m and 15/4 of 1*kg*. In the system of 1891, the *shaku-kan* system (*kanezyaku*), Japanese traditional *kuzirazyaku* (鯨尺), and the metric system were in common use. But after the law was revised in 1909 *kuzirazyaku* and yard-pound became commonly used, while priority was given to *kanezyaku* and meter (Naganuma 1910:16-21; Takahasi 1922:36, 89-90). It is notable that Japan adopted the yard-pound system as a supplementary system instead of the exclusive usage of the metric system. It is assumed that the United Kingdom emerged as a friendly country to Japan as well as the strongest and most civilized country in the world during that time.

During the 1890s, quite a number of Japanese people came to Korea with the distribution of many Japanese commodities and the reformed *shaku-kan* system came to be known to Korea. The complete acceptance of the system was due to large-scale measurement and engineering works related to the construction of

railroads. In 1899, Japanese people completed the Gyeongin Railway from Seoul to Incheon, and in 1901 the construction of the Gyeongbu Railway from Seoul to Busan started. Many Koreans were mobilized as light laborers. In spite of the same use of *shaku* or *cheok* (尺 in Chinese letter), the length of the linear units between Korea and Japan was a little different and it was necessary to make them identical. Kasai Aiziro (笠井愛次郎), who joined in drawing up the blueprint of the Gyeongbu Railway, tried to solve the problem by adjusting Korean *yeongjo-cheok*, which was 1.01 times longer than the Japanese *kanezyaku*, to the *kanezyaku* standard (Guksa pyeonchan wiweonhoe 1996:189, 191). It seems that later laws followed this adjustment.

On July 19, 1902, Pyeongsikwon who managed the nationwide business of weights and measures was established at Gungnaebu (Imperial Household Agency). Yi Jae-wan, cousin of Emperor Gojong and minister of Gungnaebu, took charge of the business. On October 10, 1902, Doryanghyeong-gyuchik (Regulations upon Weights and Measures) made by Pyeongsikwon was proclaimed. Except that the weight unit was decided not in *kan* (貫, *gwan* in Korean) but in *nyang*, or 1/100 of *kan*, Articles 1 and 2 were identical with the Japanese law of 1891. That is, while regulating *cheok* and *nyang* as the base units of length and weight, the prototypes of meter and kilogram were presented as their physical standards. Korean regulations of 1902 presented the metric conversion tables more precisely than those of Japan. One thing was different from the Japanese law of 1891: Pyeongsikwon monopolized the production of copies of standard measures. It might have been a way of securing the income of the Imperial Household. The Korean government obtained a loan of 150,000 yen from Japan's Daiich Bank and joined in this business. It seems that the Japanese engineer Inoue Yosihumi (井上宜文) was employed as an inspector at Pyeongsikwon and he played an important role in establishing Pyeongsikwon and making regulations in 1902 (Guksa pyeonchan wiweonhoe 1996:196-8). In 1905, the business of weights and measures was transferred to Nongsanggongbu (Ministry of Agriculture and Commerce) and Doryanghyeong-beob (Law on Weights and Measures) was proclaimed. The big difference from the 1902 regulations was that while increasing the volume units of *jak, hab, seung* (*doe*), and *du* (*mal*) to thrice the volume that was regulated in 1902, *seok* (石) was made identical with the Japanese scale by adjusting 150 *seung* to 100 *seung*. Accordingly, 1 *mal* which was about 6 ℓ in 1902 (See Figure 4) was changed to about 18 ℓ.

Figure 4 Prototype of *Du* Produced by Pyeongsikwon (Diameter 21.5*cm*, height 21.5*cm*, about 6ℓ.) "1 *du* (一斗)" was engraved on the front (left) and "Pyeongsikwon" in the rear.

Source: Gukrib minsok bakmulgwan 1997: 8, 98

Though *cheok*, *seung*, and *gwan* were regulated as base units according to Law No. 26 of Doryanghyeong-beob from September 20, 1909, the base units based on the prototypes of meter and kilogram were deleted and it was regulated that the sizes should follow the law of Japan (Article 2). As to weight, traditional *nyang* was abolished and *gwan*, 100 times of *nyang*, was regulated as a base unit like that of Japan. Introducing the Japanese linear units *gan* (6 *cheok*) and *jeong* (6 gan), *ri* (里) which was widely used in measuring distance was adjusted to 36 *jeong* (12,960 *cheok*). The new 1 *ri* was about 10 *ri* according to the Korean traditional unit. The traditional units of area, *gyeol*, *bu*, *sok*, and *pa* (5 square *jucheok*), whose concepts of area and yield were mixed, were abolished and the Japanese system based on the unit *pyeong* (6 square *cheok*, i.e., *kanezyaku*) was wholly introduced (Gwanbo, September 21, 1909). Though the Great Korean Empire existed formally at that time, Korea had already become a protected state of Japan as of 1905. It seems that the Japanese colonizers also drafted this law like others. This was an example that almost all the Japanese laws began to be applied to Korea before colonizing Korea completely.

Legalization and Spread of Meter

The Meiji government of Japan which had pushed forward the reform of weights and measures during the 1870s was already aware of the metric system

and international society's trend to adopt it. The metric system was one of the standards of civilization and Japan was making every effort to belong to the civilized world. Korea did not have the same amount of knowledge as Japan concerning the world's political situation and European modern civilization and Korea did not make the same amount of effort as Japan. However, Korea also entered the international system in an involuntary way at a similar period and was learning the rules of the system. In this respect, it was a natural endeavor that Korea introduced the metric system by imitating Japan.

However, the overall introduction of the metric system during the colonial period was another matter. It was the same from the viewpoint that Western civilization was a forced standard throughout the world and it was demanded that even the people living in an entirely different cultural background should adopt and learn the system through copies of copies. But in the colonial situation, the top down reform could be more overall and oppressive. The Government-General reflected more orders and policies of the imperialist government of Japan than the demands of colonial Korean society. Meanwhile, there was no representative legislature to control the power of the Government-General in colonial Korea. Executive orders of the Governor-General replaced laws and the oppressive police represented the administration. Also, the metric system that was entirely different from the traditional custom was the one that the colonial government should teach to people. It was needed to publish books, make exchange tables of weights and measures, and teach how to handle new rulers and receptacles. It was quite a troublesome work but the state could do it. In other words, it was work that could produce a "state effect" and a task worth doing since the colonial government was unable to provide any justification for another rule.

In this situation, the overall introduction of the metric system was made in Chosendoryōkōrei (朝鮮度量衡令 Executive Order upon Weights and Measures in Colonial Korea) in February 1926. It was a measure that followed the enforcement of the exclusive usage of the metric system by amending Japanese laws on April 11, 1921. In this executive order, while meter and kilogram were designated as base units (Article 1), the extended metric system for temperature, density, pressure, and power in addition to previous length, volume, and weight was introduced. These regulations designated the metric system as a single legal metrology but didn't force its exclusive usage. That is, as an interim measure, it was permissible to jointly use such weights and measures as the traditional *cheok-gwan* system or the FPS system until the end of June 1939 in the case of

public agencies and such businesses as electricity, gas, water service, or motor and until the end of June 1944 in other cases (Sinagawa 1934: appendix 27-31, 61-4). Since 1927, the Government-General positively encouraged the usage of the metric system in grain sales.

But the overall practice of the metric system needed an enormous amount of budget to produce metric measures, change handbooks and other official documents that were recorded in *cheok* and *gwan*, and teach the metric metrology to common people. Under a colonial situation, such a reform could be mistaken for a conspiracy to destroy traditions and customs and cause the resistance of the Korean people. In fact, the tendency not to abandon traditional weights and measures and the FPS system was greater in Japan. The Government-General actually showed the will to enforce the usage of the metric system more strongly in colonial Korea. However, it was not until the end of March 1946 that the period to enforce the exclusive usage of the metric system throughout the country was adjusted again (Chosun Ilbo, November 28, 1933).

By that time, Korea had been liberated but there was no change toward the exclusive usage of the metric system. Under its military administration, USAMGIK (The United States Army Military Government in Korea) prohibited the usage of the American, Japanese, and traditional Korean and Chinese weights and measures and announced previously the exclusive usage of the metric system (Chosun Ilbo, April 16, 1946). As the government of the Republic of Korea didn't enact measurement laws until 1961, the Governor-General's Executive Order was still in effect. In the meantime, the *cheok-gwan* system mixed with the Japanese system and such particular units as inch and yard that were used according to the objects measured were used habitually for a long time. In May 1947, the meter prototype No. 10 and the kilogram prototype No. 39 were introduced from Japan.[7] In July 1959, the government of the Republic of Korea joined the Meter Convention and attended the 11th General Assembly of CGPM for the first time in November 1960 (Park 1987:25).

On May 10, 1961, just before the military coup of General Park Chung Hee, Law No. 615 Kyeryangbeob (Measurement Law) was enacted, proclaimed, and

7. There is a theory that Japan took the prototypes that the government of the Great Korean Empire had bought around the time Pyeongsikwon was established in 1902 and "returned" them at that point. There is also another theory that the USMGIK bought them from the Japanese government at that time. Referring to various materials and context, the former is not probable. Refer to Park and Kim 1990.

put into force from that day on. Chosendoryōkōrei that had been in effect until then was abolished.[8] Though there were many more articles and precise regulations, this law was not far from the Executive Order of the colonial period on a large scale. The metric system was naturally regulated as legal metrology and its exclusive usage was also regulated. But the use of customary weights and measures was allowed for the time being. The exclusive usage of the metric system was set to begin on January 1, 1964. However, concerning the area of land and building, non-metric measures were allowed and in 1983, their usage was legally prohibited. Of course, as mentioned above, many people still used the units of *pyeong* and *don* afterwards and it was not until 2007 that the government strongly prohibited their usage.

Consistent Resistance of Customary Weights and Measures

The customary system of weights and measures disappeared slowly. Since the establishment of the Republic of Korea, three currency reforms (1950, 1953, and 1962) were possible by means of a blanket change but the case of weights and measures was different. Enumerating or measuring various things was different from marking the price in a currency. Though petroleum can be measured in cubic centimeters or liters and there is an apparatus called meter, the customers at the gas station frequently ordered "fifty thousand won worth of gas" or "fill it up" instead of "100㎝" or "2 ℓ." There are many watermelons of different weight at the store and they are sold not by the weight but by the unit. The merchandise whose packaging has already been decided is sold according to the package unit. Therefore, though the metric system was an epoch-making attempt to combine the units of scientific measurement with the buying and selling units, the two cannot actually be the same. It is very difficult to explain the process of buying and selling beef at a butcher's from the viewpoint of measuring units in present day Korea. Though the use of the unit of *geun* is prohibited and there is no scale showing the unit of *geun*, most people buy beef by the unit of "*han* (1) *geun*," "*du* (2) *geun*" or "*ban* (half) *geun*." Turning 1 geun into grams, it should be exactly 600g but is actually around 600*g*. Of course it is dif-

8. Hereinafter, I refer to the web database provided by Beobjecheo (Ministry of Government Legislation) for the Republic of Korea's law on measurement (http://klaw.go.kr/).

ficult to measure beef exactly: it can be 592*g* one time and 613*g* another. Most butchers usually sell a little more than 600*g* of beef at the price of 600*g*. Though the electric scale shows the weight and price at the same time, most butchers give a little extra for free or round down the price by 10 or 100 won.

A 1986 report of the Seoul Chamber of Commerce and Industry seems to be the first thorough research on the units of buying and selling in Korea, which is halfway between 1964 when the exclusive usage of the metric system began legally at least and the present year of 2008. According to the report, the relative frequency of the retail price unit of rice is shown in Table 2. *Gamani*, which is said to have derived from *kamasu* (叭) and come from Japan in the early twentieth century, is a sack containing rice. In the *cheok-gwan* system that was mixed with the Japanese system, 1 *gamani* was counted as 5*du* (*mal*) or 1/2*seok*. *Any package* in Table 2 seems to be connected with so-called "bongji-ssal," which refers to the small paper bag with which people bought and carried 1-2 *doe* of rice at every meal because they couldn't afford to buy rice, the staple food of Korea, in a bigger unit. Table 2 shows that only 1.3% bought rice by the unit of kilogram and the rest (98.7%) followed the traditional *cheok-gwan* system in some way. Nowadays, the unit weight of kilogram in packages is given a great deal of consideration.

One notable thing is the strategy of discourse as to the origin of the customary weights and measures. In fact, the customary units are not always the product of the long past. Historically speaking, Korea abandoned the *cheok-gwan* system and changed to SI. But based upon the objects, not only the *cheok-gwan* system but also the FPS units and other units are being used. The size of a TV screen is indicated in inches and the measuring unit of cloth is *ma* (碼), another name for yard. The trading unit of oil is barrel and the unit of a boxing glove is

Table 2 Relative Frequency (%) of the Units of Buying Rice in Spring 1986

Units of Buying & Selling	Metrological System	Relative Frequency (%)
Mal (du)	*Cheok-Gwan* System	51.8
Gamani (=5 Mal)	Japanese Units Absorbed into *Cheok-Gwan* System	17.2
Doe (Seung)	*Cheok-Gwan* System	16.3
Any Package	-	13.4
Kilogram	Metric System	1.3

Source: Daehan Seoul sanggonghoeuiso 1986:20

ounce. When measuring the sailing distance and speed of a ship, nautical mile (1852*m*) and knot (nautical mile per hour) are used. It is also another custom that a supplementary unit, liter (1 ℓ = 0.001 m^3 = 1,000 cm^3) is used instead of the SI units m^3 or cm^3 when measuring liquids; calorie is used instead of the SI unit *J* (joule) on food labels; and cc (cubic centimeter) is used instead of the official cm^3 in everyday life. In fact, few Koreans say that the traditional system of weights and measures can be included in proud traditional culture.

More strictly speaking, the traditional Korean units of weights and measures do not exist, or at best cannot be specified. Since the traditional *yeoung-jo cheok* was adjusted to *kanezyaku* in 1902 and it was called *cheok* by then, the Japanese units were introduced into area and volume of streets and lands. In this way, the traditional units were mixed with those of Japan, and the size and scale was adjusted to the Japanese one although they maintained their old names. The premodern era, which was before the 1902 enactment, belonged to a different time when people had totally different ways of thinking on the metrology system. How can we compare today's politics, which is performed by universal human rights, popular sovereignty, referendum, and the separation of powers, with the fairness of the metrology system? If this is not the case, our effort to investigate the disorder of the premodern metrology system and to identify the exact size and scale of the system with today's accuracy and precision seems to be a vain attempt of anachronism.

Although in a negative way, on the other hand, the prohibition against customary weights and measures is being united with the discourse concerning national tradition. The use of the units of area and weight, *pyeong* and *don*, among the customary weights and measures that had been left until recent times was prohibited last year. The reasons stated by the government for the prohibition, which were used to mitigate social resistance, were that they are not traditional, that is, of Korean origin, but Japanese-origin units and are remnants of the colonial period. The propaganda produced the intended effect and the usage of *pyeong* and *don* disappeared rapidly after the enforcement. Of course, though *don* is obscure in origin, it is true that *pyeong* shares Japanese origin. However, what is more important than indicating them as Japanese in origin is to question how they have been used as indispensable units without any problem for a century in spite of their origin. Also, why is the fact that the metric system came from a western culture, more accurately from France, not mentioned at all? This seems to be a sad facet of Korean nationalism nowadays.

Conclusion

The metric system had been adopted quite early considering that Korea opened its ports and entered the international system in the 1860s. However, consistent antipathy and resistance to the system continued in everyday life for over a century. Whether in acceptance or resistance, weights and measures haven't been the object of social and public discussion in modern Korea. Whether it was the imperial government, the colonial government or the nation-state, the government unilaterally decided and led for the usage of the metric system. In particular, the government's one-sidedness is a general characteristic of Korean modernization.

Such one-sidedness by the government for the metric initiative was partly due to the prestige of Western civilization in the process of Korea's modernization. If the important choices that Korea needed to make have already been accomplished in the midst of advanced experiences of Western modernity or Western things are the standard of civilization or the global standard, it would be a waste of time to debate such choices again. What is important to an undeveloped or under-developed country is not a dissipating argument but to learn the global standards quickly and catch up with the developed countries. Then the adherence by undeveloped or underdeveloped countries to Western global standards will be greater than the Western countries. However, such an attitude will be a negative element when Korea tries to produce global standards.

Meanwhile, isn't it true that the domination of the metric system and its acceptance in Korea is just peaceful internationalism that is wholly different from imperialism and isn't the international cooperation and consensus in science and technology quite different from politics? In the latter half of the nineteenth century, Western Europe experienced the spontaneous acceptance of norms not by imperialist intrusion or compulsion of the powers but in the midst of multilateral cooperation. The international movements of science were one of the most important norms and resulted in today's international government organizations, international non-government organizations, and international agreements. During the 1840s when France invented the metric system and put it into practice in spite of its trials and errors, it seems that there was a nationalist element in France. However, since the 1850s when many countries tried to make the metric system accepted internationally, such efforts led the metric system to be universal. Therefore, the metric system didn't become inherently the thing for all human beings as it was founded on nature but became a universal thing by

means of international cooperation in the area of science and technology and internationalism during the latter half of the nineteenth century.

Then how is the experience of Korea connected with this fact? In the latter half of the nineteenth century, Korea was in a difficult situation to exercise independent diplomacy and the process of accepting the metric system coincided with the process of colonization and de-colonization. It was not until 1960 that Korea entered CGPM as a sovereign nation when another world order and hegemony different from the internationalism of the nineteenth century had been formed.

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