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What Decides the Lifespan of Standardized Technologies? The first look at de jure standards in Japan

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What Decides the Lifespan of Standardized Technologies?
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Abstract

In this paper, factors related to the lifespan of de jure standards in Japan are first looked at and discussed. It is anticipated that knowing these factors will improve the management system for de jure standards and facilitate effective control of the associated administrative costs. This is important because newly producing and then maintaining standards require both human and financial resources. Under the system used by the Japanese Industrial Standards Committee, the review period for standards is five years, but some specific standards with important lifespan-related characteristics are identified. These standards, which are identified by examining lifespan-related factors, can be given a longer review period. As a study result, by using the record of about 4,500 standards, the de jure standards of some industry technology areas are shown to have a tendency toward a longer lifespan.

Keywords: Lifespan, De jure standard, Industrial category
JEL classification: O30

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1. Introduction

In this paper, factors related to the lifespan of de jure standards are discussed. In identifying these factors, it is anticipated that the management of de jure standards can be improved and the administrative costs can be more effectively controlled. In Japan, De jure standards are prepared by in the Japanese Industrial Standards Committee (JISC). Newly producing and then maintaining standards requires both human and financial resources. Under the current JISC rules, standards are reviewed every five years. However, some specific standards that have factors relating to longer lifespan are identified. These standards can be changed to make the review period longer. In addition, for standards, in technology areas that tend to have a shorter lifespan, it would be more appropriate to set a review interval shorter than the current five years, and this would allow for more effective management. These research results provide a first step in the analysis of abolished Japanese de jure standards.

For this study, lifespan, defined as the number of years between the year that a standard was established and the year that it was abolished, is used as the dependent variable. As input, factors that are supposed to be related with lifetime are used. Specifically, the following factors are examined: industry sector; relation with an international standard; legal status (e.g., whether the standard has been incorporated into legislation); revisions (including lack of revisions); and type of standard. Industry sector is supposed to have a relation with the lifespan of associated standards because the product lifecycle is related to the age of the standard. A relation with international standards is supposed to have an effect on lifespan because changes in an international standard—such as a standard of the International Organization for Standardization (ISO) or the International Electrotechnical Commission (IEC)–can lead to amendment of the corresponding standard in the Japanese Industrial Standards (JIS). Revision status of a standard may have a relation with lifespan because revisions are presumed to lead to a renewal of the technology targeted by the standard. The type of the standard may have a relation with the lifespan since the production standards will be no longer necessary once the product has been supplanted in the market. About 4500 abolished JIS standards are surveyed. As the result, the standards of certain industrial sectors are observed to have longer lifespans than those of other industries.

2. Literature review

As a case study of the effects of technology standards, the de facto standard of typewriter keyboards was investigated by David (1985). In the research, it was seen that the technology standard has lasted for about 100 years, even after more efficient keyboard arrangements were developed. According to David, the key arrangement that was first developed is not the most efficient arrangement possible and was, in fact, designed to reduce typing speed. This feature of the design was important at the time of introduction (about 100 years ago) because the natural typing speed of humans was faster than the mechanical capabilities of the typewriter.

Today, the mechanical problem is moot because nearly all typewriters have been replaced by personal computers. Today, input to personal computers can even be provided through a virtual touch panel keyboard in place of a physical keyboard. Hence, replacing the arrangement of the keyboard would improve efficiency. Nevertheless, the QWERTY keyboard layout is still in use, even in touch panel interfaces. This case shows a lock-in effect so strong that it effectively prevents changing the basic interface of personal computers. David used this case to illustrate the persistency of standards. Another case study, this one covering de facto standards in the fields of audio-visual and information technologies, was conducted by Yamada (2005). That research showed that a de facto standard is established when the market share of a product reaches 2–3%. David's research explained the persistency of standards in terms of a lock-in effect, focusing on human learning, but factors related to market dynamics were not analyzed. Yamada's research gives some guidelines about the timing of formation for de facto standards, but determinative factors other than market share were not discussed. In both cases, the focus is on de facto standards, rather than on de jure standards such as JIS standards.

To elucidate the role that international coordination plays in standards, the role of standards for international trade flows was studied by Blind and Jungmittach (2005). With regard to the role of the type of standard for innovation management, the importance of de jure standards in emerging research fields is emphasized. In the case of nanotechnology research, the fundamental subjects, such as definitions of terminology, are essential. In addition, fundamental standards relating to safety and human health are important (Blind and Gauch, 2009). De jure standards are particularly important for market production because they can act as safety guidelines. Without safety guidelines, corporations will find it quite daunting to take positive action in some areas of research and development because evaluating the safety and health risks of a company's products will be difficult for that company by itself.

As for consistency between JIS and international standards, about 6000 of 10,000 examined standards were related to an international standard (JIS, 2013). Harmonizing with international standards has become more important since enforcement of the World Trade Organization's Technical Barriers to Trade (TBT) agreement began in 1995. Since then, JISC has been promoting consistency between JIS and international de jure standards, such as those published by ISO and IEC. However, the relation between JIS standard lifespan and international standards has not been studied since TBT enforcement in 1995.

In terms of relation with laws, JIS is used in some laws and regulations, such as the Pharmaceutical Affairs Act, the Fire Service Act, and the Human Resource Development Promotion Act. It is reported that the JIS is cited around 6500 times in Japanese law (JIS, 2013). The relation between legal citations and JIS standard lifespan has not been studied previously.

With regard to the JIS standards preparation process, standards are prepared according to the needs of the private sector. Around 80–90% of JIS standards are newly established or revised as a consequence of proposals from the private sector made under Article 12 of the Industrial Standardization Act (JIS, 2013). In the formation process, shown in Figure 1, a draft standard for the JIS is prepared by an interested group. This is then submitted to a drafting committee whose participants are drawn from among producers, users, and neutral parties. If this step is successful, then, as a next step, the confirmed draft is sent to JISC. Finally, the draft is deliberated by JISC and may be authorized (Tamura, in press).

[Figure1]

3. Hypotheses

In this research, several hypotheses are formulated and examined by ordinary least squares (OLS) analysis of regression models. The economic value of standards can be measured in several ways. The lifespan is one way of assessing the value. Under JISC rules, each JIS standard is reviewed every five years; at review, whether to abolish the standard is decided by considering the opinion of those in the related industrial sector. This means that if a standard is not needed at a 5-year review, then few will ask for the standard to be continued, and it will be abolished. It is worth noting that low sales of the booklet for a standard do not necessarily imply low need for that standard. Total sales of booklets will be affected by the size of the relevant industrial sector. Small industries will purchase few booklets. This is analogous to journal citations: in research fields where many researchers work, such as bioscience, the number of article citations will be higher than in a smaller field. Another reason that sales is not an appropriate proxy for estimating the economic value of a standard is that booklets are unlikely to be purchased more than once by each person who uses the standard as long as the standard remains unchanged. In this research, the lifespan of a standard is used as a proxy for the economic value of the standards.

Although the details vary by industrial category, the age of a standard is supposed to be related to the stage in the product life cycle. When a product is supplanted in the market, the related standard is supposed to be abolished. Each standard is associated with a specific industrial category, and in the JIS classification scheme, there is a category for management standards. Management standards are rule-related standards that are used as rulesets in organizations and in society. This research includes management standards within the analysis scope.

Some JIS standards were prepared on the basis of international standards in order to have standards that are harmonized domestically and internationally. In the analysis here, “international standards” refers to ISO standards and IEC standards. When an international standard is converted into a JIS standard, it is likely that there will be both positive and negative effects on lifespan. As a first point, the contents of the associated international standards are anticipated to be used in more areas and countries than the JIS standards. Hence, relation with an international standard tends to produce a strong lock-in effect, and the standard is thus less likely to be abolished. Because of this, the lifespan of locked-in standards will tend to be longer. However, because revisions or amendments of the international standard will trigger corresponding changes in the JIS standard, the average lifespan of international-related standards may be shorter.

Some standards have legal effects, and one of the important roles of the JIS is to provide national rules for Japan, where JIS is the de jure set of standard. Some laws use JIS for quantitative regulation and for reference. As such, this usage requires stability to be in line with the regulative purpose, and so it is hoped that such standards will stay in force. In addition, to change laws and administrative rules that use JIS, a formal process, typically involving Congress or the Cabinet, is needed. As a result, JIS standards in legal usage are usually thought to be have a longer lifespan. This motivates the hypothesis that legal effect of a standard is related to longer lifespan.

The revision of standards is likely to extend the lifespan of those standards because when revisions are made, progress in the technology will be incorporated into the revised standards. Hence, technological progress will be reflected in the contents of the standards, and so revision should extend the lifespan of a standard.

The type of a standard may be related to its lifespan. For example, in the case of measurement standards, the described measurement method may be used to gather information about the quality of products. However, the need for standards concerning specific products will diminish as those products leave the market. Hence, examination-related standards seem, in general, to be useful over a longer span than production-related standards. Nevertheless, it is also possible to anticipate a relation in the opposite direction: in industries where radical innovation is more frequent than incremental innovation, innovations in products and measurement cannot lag behind. Thus, innovation in products and measurement will happen together. When an obsolete product leaves the market, the associated measurement methods will also leave the market. In such industries, measurement standards may have lifespans similar to those of product standards. This means that technological replacement will be accompanied by the replacement of measurement methods. In short, in industrial sectors with frequent and radical innovations, measurement standards will be less static. For example, when digital media such as CDs (compact discs) were introduced, technology related to analog storage disappeared from the market, and so data-correction methods for analog storage devices were also less needed.

From the above background, the following formal hypotheses are used in this research for model testing.
H1. The industrial sector is related to lifespan.
H2. JIS standards associated with an international (ISO or IEC) standard will have a different lifespan than unassociated standards.
H3. JIS standards cited in law will have a longer lifespan than those not cited.
H4. Revised JIS standards will have a longer lifespan than unrevised standards.
H5. The type of standard is related to lifespan.

4. Models

The following estimation equations are formulated and used to test the hypotheses.

(1) For H1, H2, H3, and H4, the following model is used.

$$\text{Model 1: } Lifespan = cons + \sum Ai * category\ of\ standard\ (dummy) + B * international\ standard\ status\ (dummy) + C * legal\ status\ (dummy) + D * revision\ (dummy) + \sum Ei * established\ year\ (dummy) + \sum Fi * end\ year\ (dummy) + u \quad (1)$$

category of standard: technology category dummies (see Section 5)

international standard status: 1 if related to an international de jure standard, 0 otherwise

legal status: 1 if in legal use, 0 otherwise

revision: 1 if revised at least once, 0 otherwise

established year: dummies for year standard was established

end year: dummies for year standard was abolished

cons: constant term

u: error term

(2) For all hypotheses (H1, H2, H3, H4, and H5) the following model is used.

$$\text{Model 2: } Lifespan = cons + \sum Ai * category\ of\ standard\ (dummy) + B * international\ standard\ status\ (dummy) + C * legal\ status\ (dummy) + D * standard\ type\ (dummy) + E * revision\ (dummy) + \sum Fi * established\ year\ (dummy) + \sum Gi * end\ year\ (dumm\square) + u \quad (2)$$

standard type: dummies for function of standards

other variables: as in Model 1

In Model 2, the type of standard (e.g., production, measurement, or design) is considered by adding additional dummy variables.

5. Method

OLS analysis is used to estimate the coefficients for the models and to test the hypotheses.

(1) Dataset

In this research, data on abolished JIS standards were examined to elucidate the relation between lifespan (age at abolition) and the following factors: 1) industrial category, 2) relation to an international standard, 3) relation to legislation, 4) revision status, and 5) type of standard. The set of abolished standards was taken from a JISC dataset. At present, around 12000 JIS standards are in effect, and about 7600 have been abolished. For the purpose of this study, a standard is regarded as abolished according to being registered as abolished in the JISC dataset. From among the abolished standards, those for which complete data are available were chosen for analysis. After data treatment, 4483 standards (i.e., observations) were included.

The technology categories specified for JIS standards were used as the technology categories in the models, and dummy variables were prepared for category. JIS data were used to identify each of the following statuses, and a dummy variable was set for each: relation with an international (ISO or IEC) standard; formal relation with legislation; and having at least one revision. For each standard, the type of standard was determined from the words in the title of the standard, and categorized into one of three types: product; test or measurement; and design. Dummy variables for the time that each standard was established (beginning) and was abolished (ending) were prepared, using ten year intervals.

The dependent variable in the models is lifespan, which is measured in years. As shown in the Appendix, the variables "c1" to "c19" correspond to the following technology categories of JIS technical standards: (c1) "A: Civil engineering and architecture"; (c2) "B: Mechanical engineering"; (c3) "C: Electronic and electrical engineering"; (c4) "D: Automotive engineering"; (c5) "E: Railway engineering"; (c6) "F: Shipbuilding"; (c7) "G: Ferrous materials and metallurgy"; (c8) "H: Non-ferrous materials and metallurgy"; (c9) "K: Chemical engineering"; (c10) "L: Textile engineering"; (c11) "M: Mining"; (c12) "P:

Pulp and paper"; (c13) "Q: Management systems"; (c14) "R: Ceramics"; (c15) "S: Domestic wares"; (c16) "T: Medical equipment and safety appliances"; (c17) "W: Aircraft and aviation"; (c18) "X: Information processing"; and (c19) "Z: Miscellaneous". The presence of a related international standard is indicated by the variable "iso_iec". Use of a standard in legislation or regulation is reflected by the variable *legal*. Whether a standard has been revised is reflected by the variable "re". For years, the dummy variables "year10b#" and "year10e#" (where # represents an index) are used to represent the formation and abolition years, respectively. Among the categorical variables, c1 "A: Civil engineering and architecture" (technology category), year10b1 (starting year), year10e1 (ending year), and type3_p (standard type) are used as the default categories. "A: Civil engineering and architecture" was selected as the default industrial category because of its adequate number of observations and the convenience of the analysis result usage. In addition, to reduce the influence arising from the difference of the number of samples among the technological categories, the categorical variable(c1～c19) is introduced so as to improve the robustness of the analysis.

The descriptive statistics for each technology area are shown in Table 1. A breakdown of category by year is shown in Table 2.

[Table 1]
[Table 2.1]
[Table 2.2]
[Table 2.3]

A box plot of each technology area for standards is shown in Figure 2. The distribution by year of JIS standards in each technology area is shown in Figures 3.1, 3.2, 3.3, and 3.4.

[Figure 2]
[Figure 3.1]
[Figure 3.2]
[Figure 3.3]
[Figure 3.4]

The ten-year-interval count for each technology category is shown in Table 3.

[Table 3]

6. Results and discussion

Table 4 shows descriptive statistics for the variables. The correlation coefficients of these variables are shown in Table 5.

[Table 4]
[Table 5]

The regression results (using OLS) are shown in Table 6.

[Table 6]
[Table 7]

In Model 1, the effect of economic environment is controlled for by dummy variables related to the beginning and ending year. The starting year and year of abolition are reflected by decadal dummy variables. The variables "iso_iec" (representing a relation with an ISO or IEC standard) and "legal" (representing citation by a law) do not show significance. In contrast, the coefficient of "re" (revision of the standard) is significant and positive. From the coefficient of industrial sector, the categories (c8) "H: Non-ferrous materials and metallurgy" and (c13) "Q: Management systems" are not significant. The categories (c11) "M: Mining" and (c15) "S: Domestic wares" show a tendency to be significant ($p < 0.10$). The other sector coefficients are all significant. Among them, only (c17) "W: Aircraft and aviation" shows a negative coefficient, although this is relative to that for the category (c1) "A: Civil engineering and architecture".

In Model 2, standard type is not significant for any type. The results for industry category, "iso_iec", and "legal" are the same as in Model 1,

Standards are reviewed at 5-year intervals, but those standards likely to have a longer lifespan would be appropriate to review at larger intervals. Among industrial categories, those with larger coefficients have tended to have longer lifespans. The coefficients greater than 2 are highlighted in Table 7, for (c6) "F: Ship building", (c2) "B: Mechanical engineering", and other categories. These long-lasting technology categories include the mechanical engineering category, in which corporations with a higher R/S value than the average in their industry sectors tend to participate in the JIS standard setting process (Tamura, in press). As a consequence, the standards formulated by such technology-oriented participants may last longer. In terms of sectors exhibiting a shorter lifespan, (c17) “W: Aircraft and aviation” is significant, but the coefficient is around -1, which is not large in this context. Because that coefficient is calculated relative to the base case of (c1) “A: Civil engineering and architecture”, the difference between the two industrial categories does not seem great enough to warrant shortening the review period.

7. Policy implications

The administrative cost of maintaining standards would be reduced by lengthening the interval between reviews of standards. The current interval of 5 years could be lengthened for some categories, as determined by coefficient in the models. The results from Model 1 and Model 2 suggest that the following industrial categories are candidates for less frequent review: (c2) “B: Mechanical engineering”; (c6) “F: Ship building”; (c7) “G: Ferrous materials and metallurgy”; (c10) “L: Textile engineering”; (c12) “P: Pulp and paper”; and (c16) “T: Medical equipment and safety appliances”. De jure standards are prepared and used across developed countries and developing countries even though de facto standards are established by corporations from developed counties; therefore, this research result will aid in the improvement of de jure standard administrative systems, including ISO and IEC, around the globe.

8. Conclusion

Among the hypotheses, H1 and H4 are found to be significant. H1 posits a relation between lifespan and industrial category; in some industrial sectors, such as (c6) “F: Ship building” and (c2) “B: Mechanical engineering”, it would be appropriate to lengthen the review interval. H4 posits a relation between lifespan and revisions. The type of standard (such as production, measurement, or design; H5) does not seem to be related to lifespan. In addition, corresponding to an ISO or IEC standard (H2) is not significant. The effect of legal citation was examined (H3), but no significant relation with lifespan was observed. In sum, this study focused on the lifespan of abolished technology standards. Differences among industries most clearly show the relation between industry and the lifespan of standards. This means that differences in technological characteristics are the strongest influence on the lifespan of de jure standards. This result will be beneficial to governmental agencies as well as to corporations setting their R&D strategy in terms of de jure standard dynamics.

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APPENDIX:

Alphabetic JIS technology code and technology area name	Independent variable in models 1 and 2
A: Civil engineering and architecture	c1
B: Mechanical engineering	c2
C: Electronic and electrical engineering	c3
D: Automotive engineering	c4
E: Railway engineering	c5
F: Shipbuilding	c6
G: Ferrous materials and metallurgy	c7
H: Non-ferrous materials and metallurgy	c8
K: Chemical engineering	c9
L: Textile engineering	c10
M: Mining	c11
P: Pulp and paper	c12
Q: Management systems	c13
R: Ceramics	c14
S: Domestic wares	c15
T: Medical equipment and safety appliances	c16
W: Aircraft and aviation	c17
X: Information processing	c18
Z: Miscellaneous	c19

Tables and Figures

Table 1. Descriptive statics of each technology category

JIS technology category	Obs	Mean	Std.Dev.	Min	Max
A: Civil engineering and architecture	287	26.90941	11.66275	5	63
B: Mechanical engineering	576	29.86285	12.84409	5	59
C: Electronic and electrical engineering	561	26.34581	13.87089	5	60
D: Automotive engineering	108	29.40741	11.42144	7	57
E: Railway engineering	132	31.88636	11.12225	5	49
F: Shipbuilding	298	36.05705	13.80724	5	59
G: Ferrous materials and metallurgy	85	31.96471	17.93603	5	62
H: Non-ferrous materials and metallurgy	140	31.27143	10.60259	5	58
K: Chemical engineering	950	33.8	14.16053	5	62
L: Textile engineering	154	34.16883	11.37754	6	59
M: Mining	94	34.39362	10.18561	17	59
P: Pulp and paper	61	37.45902	6.707145	13	58
Q: Management systems	14	8.785714	1.80506	7	12
R: Ceramics	91	37.3956	10.51124	6	57
S: Domestic wares	172	25.23837	11.11851	5	56
T: Medical equipment and safety appliances	152	33.27632	16.37685	5	57
W: Aircraft and aviation	60	22.53333	12.67918	5	48
X: Information processing	237	14.60338	6.040372	5	39
Z: Miscellaneous	311	28.88424	11.93015	5	58

Table 2.1. Yealy distribution of JIS standards in each technology category

	Lifespan													
Technology category	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A: Civil engineering and architecture	4	4	3	5	3	6	6	6	7	6	11	5	4	4
B: Mechanical engineering	5	3	3	11	12	24	23	12	6	10	8	5	5	7
C: Electronic and electrical engineering	8	9	26	11	21	15	23	5	9	12	19	20	15	9
D: Automotive engineering	0	0	1	1	0	3	5	1	1	2	1	3	4	3
E: Railway engineering	1	2	0	0	0	1	1	3	5	2	1	3	1	2
F: Shipbuilding	5	4	5	2	0	0	1	4	4	3	1	3	7	1
G: Ferrous materials and metallurgy	1	0	0	0	0	8	0	3	14	5	1	0	1	0
H: Non-ferrous materials and metallurgy	1	1	2	1	1	2	0	2	0	5	0	1	1	2
K: Chemical engineering	9	11	18	6	10	3	32	30	18	13	7	10	10	3
L: Textile engineering	0	2	1	0	0	0	2	2	2	1	3	1	1	2
M: Mining	0	0	0	0	0	0	0	0	0	0	0	0	3	1
P: Pulp and paper	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Q: Management systems	0	0	4	4	2	1	1	2	0	0	0	0	0	0
R: Ceramics	0	1	0	1	0	0	1	0	0	0	0	0	0	1
S: Domestic wares	1	2	0	0	2	10	3	4	8	0	12	4	4	11
T: Medical equipment and safety appliances	2	1	4	5	0	0	0	3	6	2	4	6	3	3
W: Aircraft and aviation	5	1	0	1	6	8	0	0	2	0	0	0	1	0
X: Information processing	10	5	3	3	13	29	19	11	5	27	37	16	7	4
Z: Miscellaneous	2	1	7	2	3	4	3	9	13	12	3	8	5	2
Total	54	47	77	53	73	114	120	97	101	100	108	85	72	55

	Lifespan													
Technology category	19	20	21	22	23	24	25	26	27	28	29	30	31	32
A: Civil engineering and architecture	3	6	10	14	7	12	7	19	7	6	7	4	6	3
B: Mechanical engineering	3	4	11	9	19	11	18	7	12	20	13	19	10	21
C: Electronic and electrical engineering	10	15	9	13	5	9	13	10	10	17	24	9	13	8
D: Automotive engineering	1	2	1	1	0	2	0	5	4	2	8	7	5	0
E: Railway engineering	0	0	2	2	2	3	1	2	3	7	4	12	5	3
F: Shipbuilding	3	2	4	5	5	6	6	5	5	2	5	7	3	13
G: Ferrous materials and metallurgy	0	0	0	0	1	0	0	0	0	3	0	0	3	1
H: Non-ferrous materials and metallurgy	1	2	3	5	1	1	5	6	2	5	1	1	7	5
K: Chemical engineering	20	7	8	7	20	9	15	10	11	14	19	33	16	8
L: Textile engineering	2	3	2	2	9	2	0	2	2	8	4	0	2	5
M: Mining	0	2	1	5	4	6	4	3	2	3	1	0	1	4
P: Pulp and paper	0	0	1	0	0	0	1	1	0	0	0	0	2	0
Q: Management systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R: Ceramics	1	0	2	1	2	0	2	2	4	1	3	2	0	2
S: Domestic wares	9	3	4	0	4	4	1	7	6	4	8	4	2	10
T: Medical equipment and safety appliances	8	3	5	5	4	1	1	0	0	0	0	0	7	0
W: Aircraft and aviation	1	0	0	1	3	1	0	5	0	4	3	2	2	1
X: Information processing	12	9	4	2	0	4	3	3	1	1	0	1	2	2
Z: Miscellaneous	14	4	8	8	5	3	5	3	0	6	8	9	5	8
Total	88	62	75	80	91	74	82	90	69	103	108	110	91	94

Table 2.2. Yealy distribution of JIS standards in each technology category

	Lifespan													
Technology category	33	34	35	36	37	38	39	40	41	42	43	44	45	46
A: Civil engineering and architecture	6	10	5	6	15	11	7	7	5	3	5	5	3	1
B: Mechanical engineering	9	19	10	10	38	15	10	17	19	21	12	12	17	5
C: Electronic and electrical engineering	9	7	7	15	16	15	11	12	7	11	14	12	5	11
D: Automotive engineering	5	4	6	6	2	1	1	3	0	4	1	0	3	1
E: Railway engineering	3	3	1	6	1	1	7	2	10	3	6	5	3	4
F: Shipbuilding	4	8	3	4	10	9	9	11	7	7	14	7	6	9
G: Ferrous materials and metallurgy	1	4	0	4	1	1	4	1	1	0	0	0	0	1
H: Non-ferrous materials and metallurgy	2	5	17	7	10	3	6	3	1	3	10	2	0	0
K: Chemical engineering	13	17	26	42	45	22	21	48	32	33	29	23	27	11
L: Textile engineering	9	0	0	3	8	5	10	3	7	7	6	8	3	7
M: Mining	5	3	5	2	1	1	3	3	5	1	4	2	9	0
P: Pulp and paper	1	9	3	6	12	5	0	5	0	1	2	5	2	0
Q: Management systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R: Ceramics	1	1	1	10	2	2	1	2	12	7	0	1	7	2
S: Domestic wares	6	0	5	3	0	5	6	2	6	3	1	1	0	0
T: Medical equipment and safety appliances	1	0	0	0	0	1	2	3	2	7	3	1	3	4
W: Aircraft and aviation	1	0	2	1	0	1	2	2	1	0	0	0	0	0
X: Information processing	0	1	0	1	0	1	1	0	0	0	0	0	0	0
Z: Miscellaneous	10	15	19	5	17	28	17	5	5	3	1	2	4	3
Total	86	106	110	131	178	127	118	129	120	114	108	86	92	59

	Lifespan													
Technology category	47	48	49	50	51	52	53	54	55	56	57	58	59	60
A: Civil engineering and architecture	2	1	3	4	1	0	1	0	0	0	0	0	0	0
B: Mechanical engineering	12	13	4	2	3	3	3	4	2	2	1	1	1	0
C: Electronic and electrical engineering	2	5	4	3	3	3	4	8	1	3	3	1	1	1
D: Automotive engineering	1	1	1	2	0	1	0	1	0	0	1	0	0	0
E: Railway engineering	5	3	1	0	0	0	0	0	0	0	0	0	0	0
F: Shipbuilding	18	5	14	2	5	7	5	2	4	3	0	2	12	0
G: Ferrous materials and metallurgy	2	1	1	2	0	4	1	2	1	3	3	2	3	0
H: Non-ferrous materials and metallurgy	0	0	4	0	1	1	0	0	0	0	0	1	0	0
K: Chemical engineering	14	17	12	23	10	24	19	8	28	11	12	2	2	0
L: Textile engineering	3	12	0	0	0	0	0	1	0	0	1	0	1	0
M: Mining	3	1	1	0	0	1	1	0	1	0	0	1	1	0
P: Pulp and paper	0	2	0	0	0	1	0	0	0	0	0	1	0	0
Q: Management systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R: Ceramics	2	1	3	3	2	2	0	0	1	0	2	0	0	0
S: Domestic wares	1	2	2	0	0	1	0	0	0	1	0	0	0	0
T: Medical equipment and safety appliances	4	0	5	13	23	0	0	0	1	4	2	0	0	0
W: Aircraft and aviation	1	2	0	0	0	0	0	0	0	0	0	0	0	0
X: Information processing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Z: Miscellaneous	3	0	2	1	1	2	4	1	1	0	0	2	0	0
Total	73	66	57	55	49	50	38	27	40	27	25	13	21	1

Table 2.3. Yealy distribution of JIS standards in each technology category

	Lifespan			
Technology category	61	62	63	Total
A: Civil engineering and architecture	0	0	1	287
B: Mechanical engineering	0	0	0	576
C: Electronic and electrical engineering	0	0	0	561
D: Automotive engineering	0	0	0	108
E: Railway engineering	0	0	0	132
F: Shipbuilding	0	0	0	298
G: Ferrous materials and metallurgy	0	1	0	85
H: Non-ferrous materials and metallurgy	0	0	0	140
K: Chemical engineering	1	1	0	950
L: Textile engineering	0	0	0	154
M: Mining	0	0	0	94
P: Pulp and paper	0	0	0	61
Q: Management systems	0	0	0	14
R: Ceramics	0	0	0	91
S: Domestic wares	0	0	0	172
T: Medical equipment and safety appliances	0	0	0	152
W: Aircraft and aviation	0	0	0	60
X: Information processing	0	0	0	237
Z: Miscellaneous	0	0	0	311
Total	1	2	1	4,483

Table3. Ten-year interval distribution of JIS standards in each technology category

lifespan(years)	A: Civil engineering and architecture	B: Mechanical engineering	C: Electronic and electrical engineering	D: Automotive engineering	E: Railway engineering	F: Shipbuilding	G: Ferrous materials and metallurgy	H: Non-ferrous materials and metallurgy	K: Chemical engineering	L: Textile engineering
to 10	19	34	75	2	3	16	1	6	54	3
from 10 to 20	58	103	137	24	19	27	32	14	146	16
from 20 to 30	95	124	125	25	26	45	4	31	120	34
from 30 to 40	73	161	110	37	42	70	19	63	243	42
from 40 to 50	35	132	83	15	42	98	7	23	246	56
from 50 to 60	6	22	30	5	0	42	21	3	139	3
from 60 to 70	1	0	1	0	0	0	1	0	2	0
sum	287	576	561	108	132	298	85	140	950	154

lifespan(years)	M: Mining	P: Pulp and paper	Q: Management systems	R: Ceramics	S: Domestic wares	T: Medical equipment and safety appliances	W: Aircraft and aviation	X: Information processing	Z: Miscellaneous	total
to 10	0	0	10	2	5	12	13	34	15	304
from 10 to 20	4	1	4	3	65	35	12	167	73	940
from 20 to 30	31	3	0	17	41	19	17	27	50	834
from 30 to 40	25	38	0	22	41	11	12	9	133	1151
from 40 to 50	29	17	0	37	18	32	6	0	28	904
from 50 to 60	5	2	0	10	2	43	0	0	12	345
from 60 to 70	0	0	0	0	0	0	0	0	0	5
sum	94	61	14	91	172	152	60	237	311	4483

Table 4. Descriptive statistics of variables

Variable	Obs	Mean	Std.Dev.	Min	Max
lifespan	4483	30.01115	13.75334	5	63
c1	4483	0.06402	0.244815	0	1
c2	4483	0.128485	0.334667	0	1
c3	4483	0.125139	0.330914	0	1
c4	4483	0.024091	0.153349	0	1
c5	4483	0.029445	0.169068	0	1
c6	4483	0.066473	0.249136	0	1
c7	4483	0.018961	0.136401	0	1
c8	4483	0.031229	0.173956	0	1
c9	4483	0.211912	0.408708	0	1
c10	4483	0.034352	0.182152	0	1
c11	4483	0.020968	0.143294	0	1
c12	4483	0.013607	0.115866	0	1
c13	4483	0.003123	0.055802	0	1
c14	4483	0.020299	0.141037	0	1
c15	4483	0.038367	0.192103	0	1
c16	4483	0.033906	0.181007	0	1
c17	4483	0.013384	0.114925	0	1
c18	4483	0.052866	0.223792	0	1
c19	4483	0.069373	0.254116	0	1
iso_iec	4483	0.152353	0.359403	0	1
legal	4483	0.003569	0.059641	0	1
re	4483	0.711131	0.453288	0	1
type1_d	4483	0.009146	0.095205	0	1
type2_m	4483	0.167076	0.373085	0	1
type3_p	4483	0.823779	0.381051	0	1
year10b1	4483	0.002454	0.04948	0	1
year10b2	4483	0.348204	0.476454	0	1
year10b3	4483	0.227303	0.419137	0	1
year10b4	4483	0.158822	0.365551	0	1
year10b5	4483	0.119563	0.324486	0	1
year10b6	4483	0.107963	0.310369	0	1
year10b7	4483	0.03569	0.185538	0	1
year10e1	4483	0.05242	0.222898	0	1
year10e2	4483	0.498996	0.500055	0	1
year10e3	4483	0.326121	0.468844	0	1
year10e4	4483	0.122463	0.327856	0	1

Alphabetic JIS technology code and technology area name	Independent variable in models 1 and 2
A: Civil engineering and architecture	c1 (Base group)
B: Mechanical engineering	c2
C: Electronic and electrical engineering	c3
D: Automotive engineering	c4
E: Railway engineering	c5
F: Shipbuilding	c6
G: Ferrous materials and metallurgy	c7
H: Non-ferrous materials and metallurgy	c8
K: Chemical engineering	c9
L: Textile engineering	c10
M: Mining	c11
P: Pulp and paper	c12
Q: Management systems	c13
R: Ceramics	c14
S: Domestic wares	c15
T: Medical equipment and safety appliances	c16
W: Aircraft and aviation	c17
X: Information processing	c18
Z: Miscellaneous	c19

Table 5. Correlation coefficients of variables

	lifespan	c1	c2	c3	c4	c5	c6	c7	c8	c9
lifespan	1									
c1	-0.059	1								
c2	-0.0041	-0.1004	1							
c3	-0.1008	-0.0989	-0.1452	1						
c4	-0.0069	-0.0411	-0.0603	-0.0594	1					
c5	0.0238	-0.0456	-0.0669	-0.0659	-0.0274	1				
c6	0.1173	-0.0698	-0.1025	-0.1009	-0.0419	-0.0465	1			
c7	0.0197	-0.0364	-0.0534	-0.0526	-0.0218	-0.0242	-0.0371	1		
c8	0.0165	-0.047	-0.0689	-0.0679	-0.0282	-0.0313	-0.0479	-0.025	1	
c9	0.1429	-0.1356	-0.1991	-0.1961	-0.0815	-0.0903	-0.1384	-0.0721	-0.0931	1
c10	0.057	-0.0493	-0.0724	-0.0713	-0.0296	-0.0329	-0.0503	-0.0262	-0.0339	-0.0978
c11	0.0466	-0.0383	-0.0562	-0.0553	-0.023	-0.0255	-0.0391	-0.0203	-0.0263	-0.0759
c12	0.0636	-0.0307	-0.0451	-0.0444	-0.0185	-0.0205	-0.0313	-0.0163	-0.0211	-0.0609
c13	-0.0864	-0.0146	-0.0215	-0.0212	-0.0088	-0.0097	-0.0149	-0.0078	-0.01	-0.029
c14	0.0773	-0.0376	-0.0553	-0.0544	-0.0226	-0.0251	-0.0384	-0.02	-0.0258	-0.0746
c15	-0.0693	-0.0522	-0.0767	-0.0755	-0.0314	-0.0348	-0.0533	-0.0278	-0.0359	-0.1036
c16	0.0445	-0.049	-0.0719	-0.0709	-0.0294	-0.0326	-0.05	-0.026	-0.0336	-0.0971
c17	-0.0633	-0.0305	-0.0447	-0.044	-0.0183	-0.0203	-0.0311	-0.0162	-0.0209	-0.0604
c18	-0.2647	-0.0618	-0.0907	-0.0894	-0.0371	-0.0412	-0.063	-0.0328	-0.0424	-0.1225
c19	-0.0224	-0.0714	-0.1048	-0.1033	-0.0429	-0.0476	-0.0729	-0.038	-0.049	-0.1416
iso_iec	-0.3014	-0.1033	-0.007	0.0985	-0.0018	-0.0518	-0.1007	0.1322	-0.0511	-0.0421
legal	-0.0199	0.0149	-0.023	0.0226	-0.0094	-0.0104	-0.016	0.0465	-0.0107	0.0239
re	0.6209	0.0742	-0.0303	-0.0564	0.0135	0.0557	0.0792	-0.0233	0.0239	0.0583
type1_d	0.0294	-0.006	0.0331	0.0345	0.0155	-0.0029	-0.0162	-0.0134	-0.0172	-0.0441
type2_m	-0.0734	0.0392	-0.0183	-0.0104	0.0544	-0.0356	-0.1123	0.0298	0.1293	0.0136
type3_p	0.0645	-0.0369	0.0096	0.0015	-0.0572	0.0355	0.114	-0.0258	-0.1223	-0.0023
year10b1	0.0623	-0.013	0.0079	-0.0051	-0.0078	-0.0086	-0.0132	-0.0069	-0.0089	-0.0257
year10b2	0.6986	-0.0687	-0.0302	-0.0896	-0.0232	-0.0276	0.0512	0.0117	-0.037	0.1847
year10b3	0.1441	-0.0179	0.0113	0.0281	0.064	0.0724	0.0412	-0.0247	0.0862	-0.0689
year10b4	-0.2127	0.1855	0.0265	0.0293	-0.0006	0.0218	-0.0327	-0.0336	0.0062	-0.1029
year10b5	-0.3748	-0.0037	0.0208	0.0061	-0.0175	-0.0113	-0.0293	-0.0311	-0.0187	-0.0178
year10b6	-0.4627	-0.0616	-0.0154	0.0661	-0.0312	-0.0478	-0.0582	-0.0273	-0.0377	-0.0432
year10b7	-0.2875	-0.0356	-0.0128	-0.011	0.0011	-0.0335	-0.0079	0.1937	-0.0138	-0.0056
year10e1	-0.083	0.0325	-0.0036	0.0018	0.1393	0.0123	0.0055	-0.018	-0.0019	-0.0705
year10e2	-0.0037	0.0379	0.0394	0.0365	-0.0259	-0.0023	-0.0138	-0.0929	-0.0355	-0.0142
year10e3	0.1416	-0.0459	-0.0495	-0.046	-0.0503	0.0393	0.078	-0.0025	0.0639	0.0759
year10e4	-0.1404	-0.0143	0.0131	0.0088	0.0167	-0.061	-0.0942	0.1576	-0.0358	-0.0389

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K: Chemical engineering	c9
L: Textile engineering	c10
M: Mining	c11
P: Pulp and paper	c12
Q: Management systems	c13
R: Ceramics	c14
S: Domestic wares	c15
T: Medical equipment and safety appliances	c16
W: Aircraft and aviation	c17
X: Information processing	c18
Z: Miscellaneous	c19

	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19
c10	1									
c11	-0.0276	1								
c12	-0.0222	-0.0172	1							
c13	-0.0106	-0.0082	-0.0066	1						
c14	-0.0271	-0.0211	-0.0169	-0.0081	1					
c15	-0.0377	-0.0292	-0.0235	-0.0112	-0.0288	1				
c16	-0.0353	-0.0274	-0.022	-0.0105	-0.027	-0.0374	1			
c17	-0.022	-0.017	-0.0137	-0.0065	-0.0168	-0.0233	-0.0218	1		
c18	-0.0446	-0.0346	-0.0277	-0.0132	-0.034	-0.0472	-0.0443	-0.0275	1	
c19	-0.0515	-0.04	-0.0321	-0.0153	-0.0393	-0.0545	-0.0511	-0.0318	-0.0645	1
iso_iec	-0.0561	-0.0447	-0.0284	0.1098	-0.061	-0.0847	-0.0005	-0.0494	0.3964	-0.0278
legal	-0.0113	-0.0088	-0.007	-0.0033	-0.0086	-0.012	-0.0112	-0.007	-0.0141	0.0131
re	0.05	0.0314	0.0621	-0.0878	0.0568	0.053	-0.0465	-0.0286	-0.2607	-0.0371
type1_d	-0.0053	0.035	-0.0113	-0.0054	0.036	-0.0192	-0.018	-0.0112	0.0297	-0.0078
type2_m	0.0173	0.0221	0.1177	-0.0251	0.0627	-0.0614	-0.0641	-0.0053	-0.0978	0.0472
type3_p	-0.0156	-0.0304	-0.1124	0.0259	-0.0704	0.065	0.0672	0.008	0.0883	-0.0442
year10b1	0.1639	-0.0073	-0.0058	-0.0028	-0.0071	0.0136	-0.0093	-0.0058	-0.0117	-0.0135
year10b2	0.0421	-0.0057	0.0556	-0.0409	0.0874	-0.0485	0.039	-0.0322	-0.1727	0.0105
year10b3	-0.0117	0.0915	0.0328	-0.0304	-0.0403	-0.0003	-0.0693	0.0341	-0.121	0.0153
year10b4	0.0186	0.0003	-0.03	-0.0243	0.0024	0.0371	-0.0511	-0.04	-0.029	0.0015
year10b5	-0.028	-0.0443	-0.0433	-0.0206	-0.0335	0.1125	0.0867	0.1007	-0.0164	-0.0167
year10b6	-0.0459	-0.0509	-0.0347	0.0836	-0.0297	-0.0657	0.0222	-0.0405	0.4061	-0.0186
year10b7	-0.0363	-0.0282	-0.0226	0.1185	-0.0277	-0.0384	-0.0294	-0.0224	0.1265	-0.0005
year10e1	-0.0334	0.0494	0.0415	-0.0132	-0.0268	-0.0105	-0.0441	-0.0187	-0.0556	0.0894
year10e2	0.1033	-0.0153	0.0445	-0.0559	-0.0013	0.1212	-0.1426	0.0895	-0.172	0.0401
year10e3	-0.0528	0.0111	-0.053	0.0037	0.0382	-0.0745	0.1825	-0.0562	-0.0113	-0.072
year10e4	-0.0593	-0.0262	-0.0204	0.0888	-0.0345	-0.0711	-0.0136	-0.0435	0.3162	-0.019

	iso_iec	legal	re	type1_d	type2_m	type3_p	year10b1	year10b2	year10b3	year10b4
iso_iec	1									
legal	0.0371	1								
re	-0.3187	0.0299	1							
type1_d	-0.0146	-0.0057	-0.006	1						
type2_m	0.088	-0.0068	-0.0483	-0.043	1					
type3_p	-0.0825	0.008	0.0488	-0.2077	-0.9683	1				
year10b1	-0.0085	-0.003	0.0316	0.0426	-0.0222	0.0111	1			
year10b2	-0.2148	-0.0123	0.4173	-0.0112	-0.129	0.1291	-0.0362	1		
year10b3	-0.1677	-0.0325	0.186	0.0541	0.0496	-0.0621	-0.0269	-0.3964	1	
year10b4	-0.1248	0.0047	-0.057	-0.0033	0.0541	-0.0521	-0.0216	-0.3176	-0.2357	1
year10b5	-0.0185	-0.0105	-0.2187	-0.0137	0.0322	-0.0281	-0.0183	-0.2693	-0.1999	-0.1601
year10b6	0.5066	-0.0088	-0.4348	-0.0334	0.0099	-0.0013	-0.0173	-0.2543	-0.1887	-0.1512
year10b7	0.3634	0.1296	-0.278	-0.0185	0.046	-0.0404	-0.0095	-0.1406	-0.1043	-0.0836
year10e1	-0.0997	-0.0141	0.0461	-0.0226	-0.0275	0.0326	0.0086	0.0445	0.042	0.0484
year10e2	-0.4231	-0.0597	0.1272	0.0353	-0.0404	0.0307	0.0226	0.1274	0.0921	0.0729
year10e3	0.1155	0.0142	0.0266	-0.0168	-0.0054	0.0095	-0.0153	-0.022	-0.0401	-0.0523
year10e4	0.5479	0.0803	-0.2633	-0.0144	0.0881	-0.0826	-0.0185	-0.1931	-0.1117	-0.0692

	year10b5	year10b6	year10b7	year10e1	year10e2	year10e3	year10e4
year10b5	1						
year10b6	-0.1282	1					
year10b7	-0.0709	-0.0669	1				
year10e1	-0.0713	-0.0818	-0.0452	1			
year10e2	0.0049	-0.2998	-0.192	-0.2347	1		
year10e3	0.034	0.1413	-0.0415	-0.1636	-0.6943	1	
year10e4	-0.0076	0.3108	0.3829	-0.0879	-0.3728	-0.2599	1

Table 6. Estimation results

	model1 (coefficient/t-value)	model2 (coefficient/t-value)
c2	2.0567 [7.30]***	2.0542 [7.28]***
c3	1.1003 [3.86]***	1.0972 [3.84]***
c4	1.2082 [2.75]***	1.2039 [2.74]***
c5	1.1824 [2.91]***	1.1844 [2.91]***
c6	3.8369 [11.89]***	3.8403 [11.85]***
c7	2.2717 [4.63]***	2.2738 [4.64]***
c8	0.2524 [0.63]	0.2551 [0.64]
c9	1.4889 [5.57]***	1.4918 [5.58]***
c10	2.2951 [5.88]***	2.298 [5.89]***
c11	0.8809 [1.91]*	0.8738 [1.90]*
c12	2.6987 [4.95]***	2.7002 [4.92]***
c13	-1.1582 [-1.08]	-1.158 [-1.08]
c14	1.3432 [2.88]***	1.3335 [2.86]***
c15	0.6355 [1.70]*	0.6399 [1.71]*
c16	2.0533 [5.15]***	2.057 [5.15]***
c17	-1.3009 [-2.36]**	-1.2956 [-2.35]**
c18	1.0596 [2.83]***	1.0524 [2.78]***
c19	1.2459 [3.90]***	1.2466 [3.90]***
iso_iec	-0.2988 [-1.27]	-0.3003 [-1.27]
legal	-0.4015 [-0.41]	-0.403 [-0.41]
re	1.7742 [10.30]***	1.7784 [10.31]***
year10b2	-5.5491 [-4.72]***	-5.5186 [-4.69]***
year10b3	-14.7586 [-12.54]***	-14.7317 [-12.50]***
year10b4	-24.5646 [-20.80]***	-24.5327 [-20.74]***
year10b5	-33.4834 [-28.20]***	-33.45 [-28.12]***
year10b6	-42.9476 [-35.66]***	-42.9072 [-35.55]***
year10b7	-48.1004 [-38.77]***	-48.0614 [-38.67]***
year10e2	6.9198 [25.83]***	6.9138 [25.77]***
year10e3	15.4446 [54.53]***	15.4389 [54.44]***
year10e4	22.0068 [64.19]***	22.0017 [64.04]***
type1_d		0.3646 [0.60]
type2_m		0.0064 [0.04]
_cons	35.6928 [29.04]***	35.6594 [28.98]***
R-squared	0.9231	0.9231
Adj-R-squared	0.9226	0.9225
N	4483	4483

[ ] t-value, * p<0.1, ** p<0.05, *** p<0.01

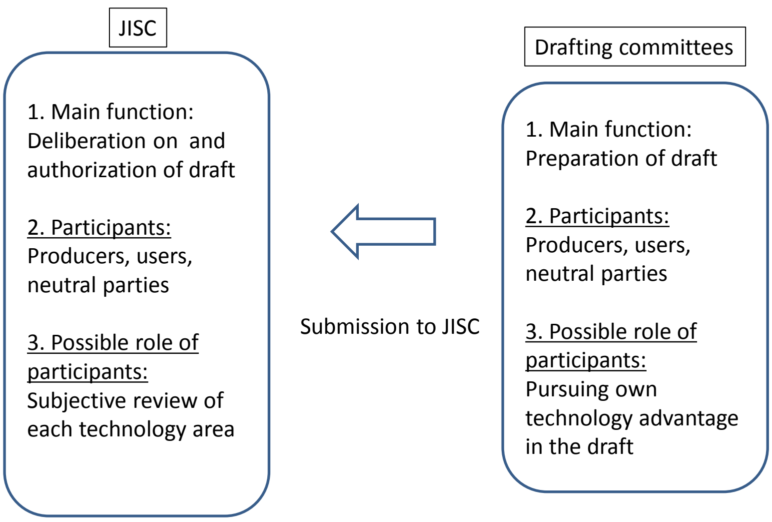
Alphabetic JIS technology code and technology area name	Independent variable in models 1 and 2
A: Civil engineering and architecture	c1 (Base group)
B: Mechanical engineering	c2
C: Electronic and electrical engineering	c3
D: Automotive engineering	c4
E: Railway engineering	c5
F: Shipbuilding	c6
G: Ferrous materials and metallurgy	c7
H: Non-ferrous materials and metallurgy	c8
K: Chemical engineering	c9
L: Textile engineering	c10
M: Mining	c11
P: Pulp and paper	c12
Q: Management systems	c13
R: Ceramics	c14
S: Domestic wares	c15
T: Medical equipment and safety appliances	c16
W: Aircraft and aviation	c17
X: Information processing	c18
Z: Miscellaneous	c19

Table 7. Technology categories and coefficients

	Positive coefficient (Model 1 / Model 2)	**Negative coefficient** (Model 1 / Model 2)	**Significant level**	**Notes**
A: Civil engineering and architecture				c1(Base group)
B: Mechanical engineering	2.05/2.05		***	c2
C: Electronic and electrical engineering	1.10/1.09		***	c3
D: Automotive engineering	1.20/1.20		***	c4
E: Railway engineering	1.18/1.18		***	c5
F: Shipbuilding	3.83/3.84		***	c6
G: Ferrous materials and metallurgy	2.27/2.27		***	c7
H: Non-ferrous materials and metallurgy				c8
K: Chemical engineering	1.48/1.49		***	c9
L: Textile engineering	2.29/2.29		***	c10
M: Mining	0.88/0.87		*	c11
P: Pulp and paper	2.69/2.70		***	c12
Q Management systems				c13
R: Ceramics	1.34/1.33		***	c14
S: Domestic wares	0.63/0.63		*	c15
T: Medical equipment and safety appliances	2.05/2.05		***	c16
W: Aircraft and aviation		-1.30/-1.29	**	c17
X: Information processing	1.05/1.05		***	c18
Z: Miscellaneous	1.24/1.24		***	c19

Note: Coefficients with absolute value greater than 2 are highlighted. (*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$)

Figure 1. Roles of the JISC technical committees and drafting committees



Reference: (Tamura, in press)

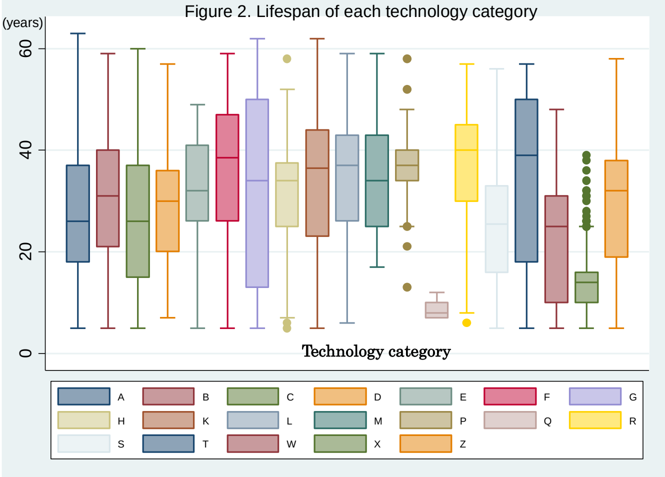


Figure 2. Lifespan of each technology category

Alphabetic JIS technology code and technology area name
A: Civil engineering and architecture
B: Mechanical engineering
C: Electronic and electrical engineering
D: Automotive engineering
E: Railway engineering
F: Shipbuilding
G: Ferrous materials and metallurgy
H: Non-ferrous materials and metallurgy
K: Chemical engineering
L: Textile engineering
M: Mining
P: Pulp and paper
Q: Management systems
R: Ceramics
S: Domestic wares
T: Medical equipment and safety appliances
W: Aircraft and aviation
X: Information processing
Z: Miscellaneous

Figure3.1. Lifespan distribution of JIS standards

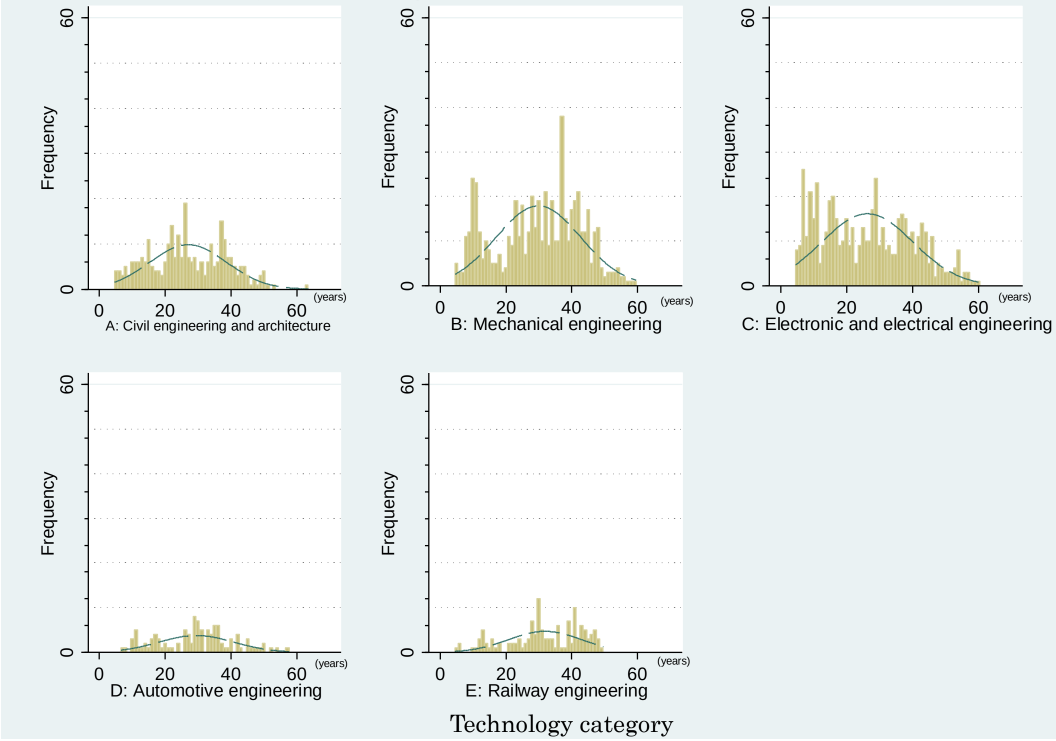
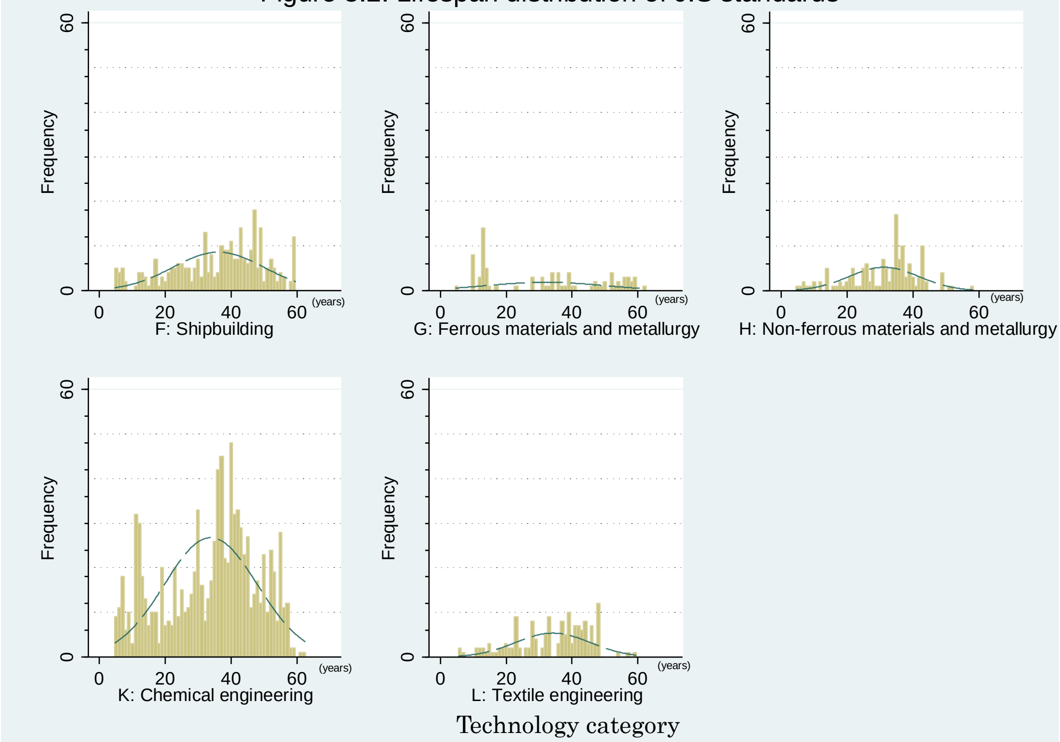


Figure 3.2. Lifespan distribution of JIS standards



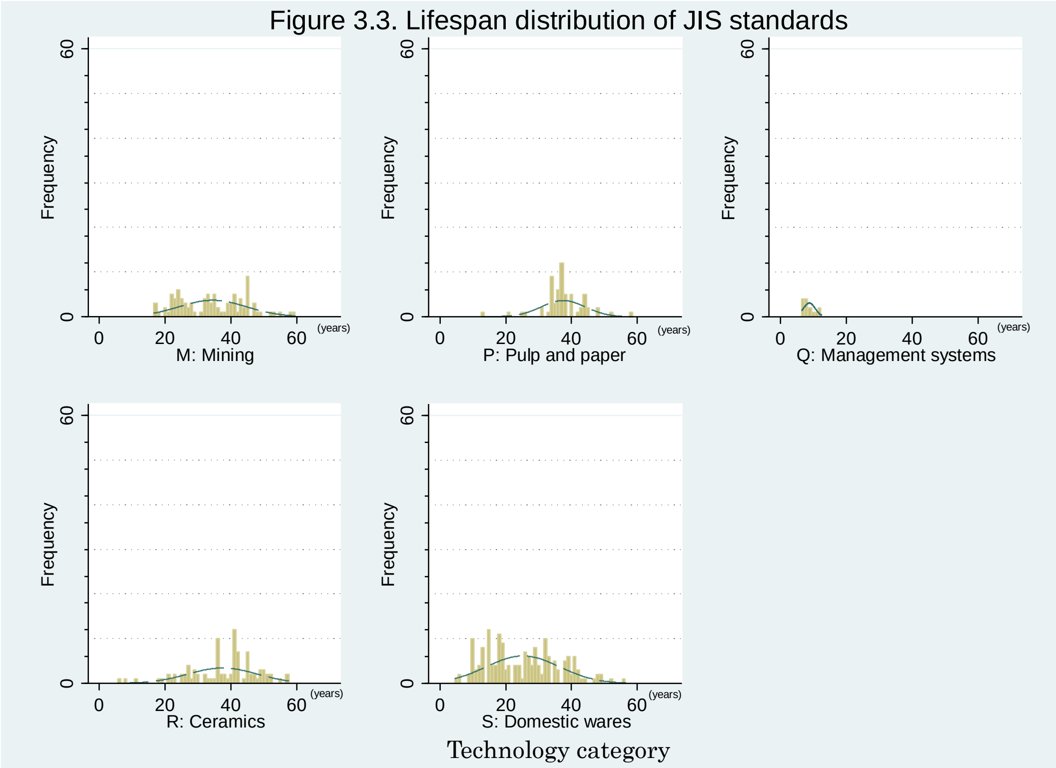


Figure 3.3. Lifespan distribution of JIS standards
Frequency
M: Mining
P: Pulp and paper
Q: Management systems
R: Ceramics
S: Domestic wares
(years)
Technology category

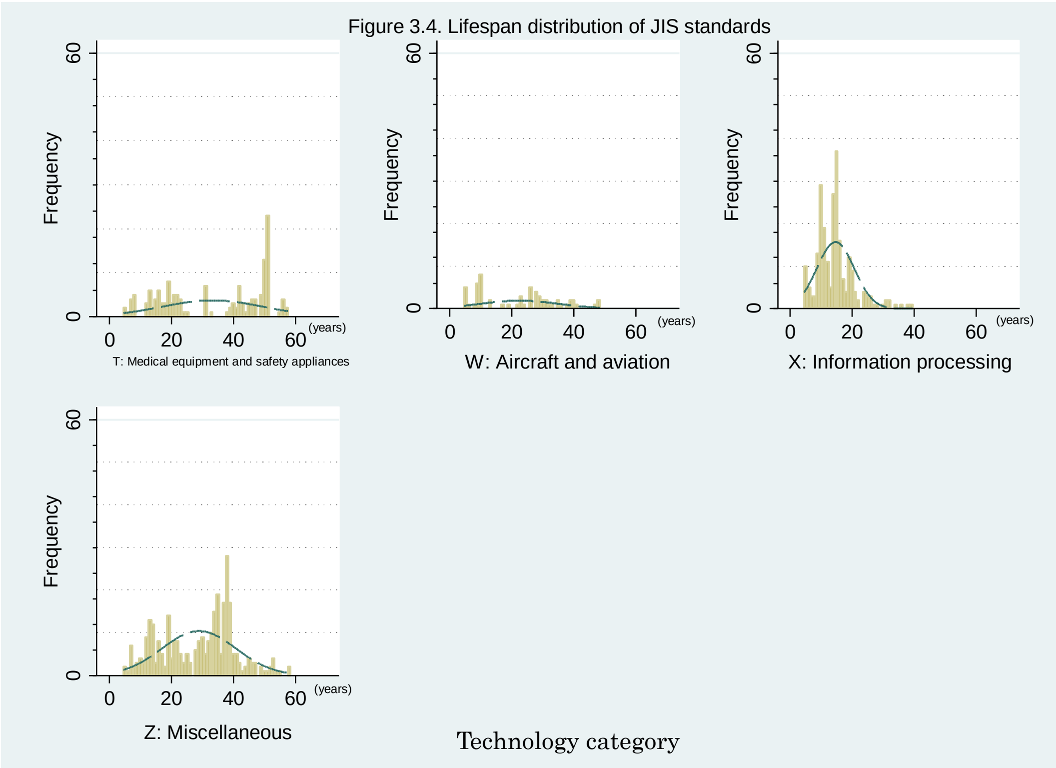


Figure 3.4. Lifespan distribution of JIS standards
Frequency
T: Medical equipment and safety appliances
W: Aircraft and aviation
X: Information processing
Z: Miscellaneous
(years)
Technology category