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Tipping, Standardization and Convergence: Catch-Up and Failure in Japan's Standards Strategy

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1. INTRODUCTION

Technical standards* are basic for using goods. If one person uses miles while another uses kilometers to describe speed/distance on a car speedometer, neither can necessarily understand it. Of course if a conversion factor exists, both can calculate the speed/distance. In this case the conversion is 1 mile \approx 1.6km. By the same token, if the electrical frequency is different, home appliances cannot be used in such different cases as 50 cycles or 60 cycles. In this case, too, a converting switch exists to change cycles. These simple examples show that technical specifications or standards are necessary for products that stipulate technical characteristics. For, if you do not know them, like foreign languages, you cannot use them (or communicate with others). Here again, however, if conversion factors (translators) exist, both can be converted.

Market size is another factor that comes into play when consumers choose a specific product. If people like a product for its features; design, form, handling, usefulness, economy and popularity, sales increase, and eventually the product will dominate the market. A slight change in the

function or character of a product's features however may produce a change in consumer response to the said product and result in falling sales and a loss of market dominance. This is called 'tipping.' One of the most notable examples is the VHS vs. Betamax rivalry for the home videotape market.

When a specific product dominates a market, standards attributable to the said product are called 'de facto standards.' VHS became the de facto standard in the above example. On the other hand, when international organizations or governments determine specific standards for public safety, the environment, etc., these are called 'de jure standards.' Norms and standards determined by the Japanese Industrial Standards (JIS) and the International Organization for Standardization (ISO) are examples of de jure standards.

Networks are common features of telecommunications, transportation (airlines, railways, and roads), electricity, mail services and online businesses. Network economy has the characteristic that the more users participate in the network, the more convenient the network becomes for the user. This is called 'network externalities.' Users may prefer a specific software or machine in the Internet world and if the network externality works, a particular product or specific software may dominate the cyber market. This is called 'locked-in effects.' It is probable overtime that the network economy will create de facto standards due to the given externalities.

It is said that convergence takes place as telecommunications and information technologies advance. Digital TV may combine with personal computers (PCs) because both utilize digital technologies. Therefore, if the same technical standards are deployed for different-purpose products, both can be converted for same-purpose usage. Thus, convergence issues are deeply related to standards.

This brief note describes the relationship between standards and consumer tastes. The first section explains tipping and de facto standards. The second section treats de jure standards. Japan's defeats in standards wars are illustrated in the third section. The fourth section again explains consumer preferences and the selection of goods based on demand or human factors. Convergence issues are also briefly examined in the fifth section and finally concluding remarks follow.

2. TIPPING AND DE FACTO STANDARDS

2.1. VHS vs. Betamax

A famous example of tipping was the market war between SONY and Japan Victor/Matsushita regarding home videocassette recorders (VCRs) (Ida [2001]). Both companies tried to introduce videotapes with a 0.5 inch width and two-hours of recording time. SONY first introduced a videotape called Betamax (0.5 inch with 1-hour playtime) with high resolution pictures in 1975. One year later, Victor marketed a videotape called VHS (0.5 inch with 2 hours playtime). The Victor/Matsushita alliance used heavy advertising to promote its VHS product. In response to the alliance's offensive SONY introduced a Betamax with a 2-hour playtime in 1977, but the Victor/Matsushita alliance already had the upper hand and had gained a 50 percent market share by 1978, and after that their share continued to expand. Finally SONY decided to produce VHS tapes in 1988, ending the videotape war.

The victory of VHS can be explained by the following factors: (i) SONY concentrated on providing the highest quality picture possible while Victor/Matsushita did not (the latter was satisfied with near-perfect but generally-acceptable picture quality levels); (ii) SONY initially sold Betamax as a superior picture product but in doing so sacrificed playtime; (iii) Victor/Matsushita on the other hand relied on extended playtime over picture quality and used their strong combined marketing power through their sales networks including rental video shops to get the message across to the general public.

This is a good example of de facto standards. However, some lessons can be drawn from this example. First, quality is an important factor in selling products but it is only one factor. Consumers may prefer tapes with longer playtime or other advantages over quality. Above-average quality may be acceptable. Second, advertising and sales networks are necessary in order to sell products. Third, those who bought Betamax (tapes and VCRs) had to eventually change to the VHS system (loss for consumers). Fourth, no converter existed between the two systems so consumers who bought Betamax were unable to convert and store old footage. Fifth, SONY faced enormous revenue losses for initial R&D, marketing costs, and finally production costs in changing from Betamax to VHS.

2.2. Forum Standards

The result of the above 'war' brought about consortium or group methods in the production of new products among manufacturers in order to avoid such enormous losses. Thus, the so-called 'forum standards' were born. This is the third way to set up standards in addition to de facto and de jure standards.

Manufacturers usually organize a consortium or association to form common standards for a new product. Membership is open (entry and withdrawal are free). A member can use other members' patents if the member also offers its patent. In this case, the time taken to formalize standards is greatly reduced and thus less initial cost is incurred. In a sense, forum standards are a kind of strategic alliance. A good example of this was seen in the development of digital versatile disks (DVD) by a consortium (later the DVD forum in 1997).¹

2.3. Voluntary Standards

Between de facto and de jure standards, there is another type of standard. That is called 'voluntary standard' (or industry-based standard). How is a voluntary standard determined in Japan? Let us take the standard on terrestrial digital TV as an example. The Ministry of Posts and Telecommunications (now called the Ministry of Public Management, Home Affairs, Posts and Telecommunications [MPHPT] after the government reform of 2001) has the Council on Telecommunication Technologies that is composed of equipment manufacturers, professors and engineers. The Council submitted a technical report on the said topic to the Ministry in May 1999 and two ministerial ordinances based on the technical report were stipulated in November 1999. These ordinances usually give only directions and frameworks. The details are discussed and determined by producer associations such as the Association of Radio Industries and Businesses (ARIB).² ARIB formulated the standard on the transmission method of terrestrial digital TV in May 2001 as its standard, ARIB STD-B31. However, these standards are not compulsory.

3. DE JURE STANDARDS

There are two types of de jure standards: one by public or government institutions: the other by international organizations.

3.1. De Jure Standards by Governments

Such items as infrastructure and public goods have de jure standards. Public standards are necessary for private goods when they are related to safety, the environment, and public health. Those standards are also called 'mandatory standards.' Moreover, stated technical standards are convenient to all users within a country so usually domestic standards are stipulated for private goods by government institutions. In the case of Japan, the most famous body is the Japanese Industrial Standards (JIS). JIS was established in 1949. JIS's role is now determined and managed by the Japanese Industrial Standards Committee (JISC) under the Agency of Industrial Science and Technology (AIST) since 1952.

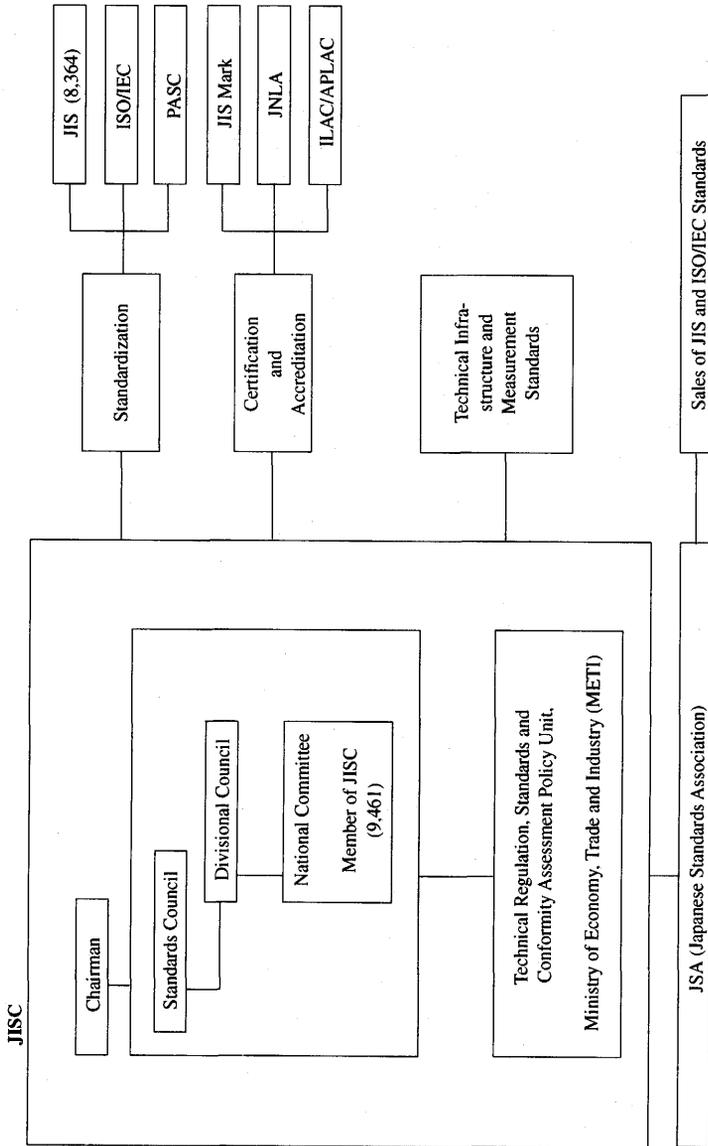
JISC's task is summarized as follows: (i) establishment and maintenance of JIS; (ii) administration of accreditation and certification; (iii) participation and contribution in ISO activities; and (iv) development of measurement standards and technical infrastructure for standardization. JISC has 9,461 national committee members and covers 8,364 JIS standards (see Figure 3.1).

Nowadays, the borderline between de jure and de facto or voluntary standards is not clear because of the very rapid technological changes. A previous standard may be outdated immediately when completely new products appear. This short product cycle, which is particularly visible in the electronics and computer industries, will change the system of public standardization. From a competition point of view a single standard hinders new developments. Whereas multiple standards enhance competition among manufacturers to obtain de facto standards. However, this also depends on the given characteristics of products and markets. It is said that one to many correspondence, such as radios and TVs (one station with many receivers), may require de jure standards since it takes time and money to transform to new ones.

3.2. Standards by International Organizations

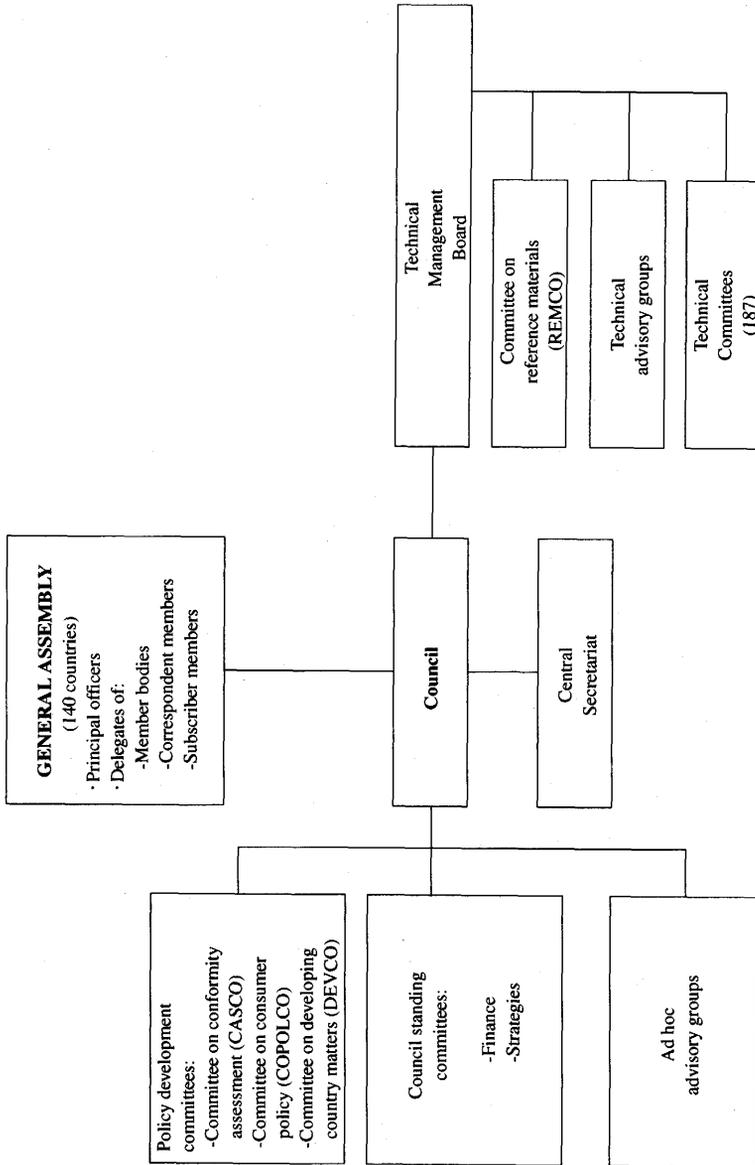
It is logical that standards for resources or goods for international use should be regulated by international organizations. Such organizations as the International Telecommunication Union (ITU), the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO) are examples. The ITU regulates IT-related standards and the IEC does the same for electronics-related standards

Figure 3.1: JISC System



Source: JISC, <http://www.jisc.org/>.

Figure 3.2: ISO Structure



Source: ISO, <http://www.iso.org/>.

while the ISO covers standards on goods and services including systems that are internationally traded.

Take the ISO for example. It was established in 1947 in Geneva and currently its members represent 140 countries. ISO has 187 technical committees with 572 subcommittees. Under the subcommittees 2,063 working groups are tackling standards for goods and services (see Figure 3.2). Each country has one vote. In the case of Japan, JISC is the representative body. Up to now, over 13,000 standards have been stipulated, from the simple screw to business models (or systems). Well known examples include the ISO 9,000 series for industrial quality and the ISO 14,000 series for environmental considerations.

It is said that a shepherd (secretariat) country in a Technical Committee can sometimes pass its own technical standards as global standards. This, of course, can lead to a form of hegemony, and the shepherd country can gain unfair advantages from such global standards (this point is addressed later). Therefore, the rule of the game to determine standards should be transparent and equal for all member countries.

Some crucial decisions have also been made by the World Trade Organization (WTO) relating to global standards. The WTO's Agreement on Technical Barriers to Trade (TBT) became effective in 1996, which determined that domestic standards sometimes work as trade barriers. The basic premise here was that ISO standards are preferable to any other standards. Since then each country has had to apply ISO standards or revise versions of domestic standards in order to comply. For instance, in the case of Japan, 2,000 out of around 8,300 JIS standards had to be revised and adjusted to comply with ISO standards between 1995 and 1998 (Jou [2001]).

4. JAPANESE DEFEAT IN THE STANDARDS WAR

It is commonly accepted that ISO's standards are strongly influenced by European standards owing in great part to the very origin of the organization. The European Committee for Standardization (CEN), established in 1961, has around 3,000 standards. 19 European countries are members of CEN and its norms are automatically treated as ISO standards (by the Vienna Agreement). European countries, especially the UK, think standards are economic weapons in international negotiations. Therefore, let us say that a country has a strategy to globally promote its own products, in such a case it is obviously advantageous to let its own standards be

global ones.

On the other hand, Japan had not shown much interest in global power games until quite recently. As a 'catch-up' country, Japan had always followed or assimilated to the environment of the host country in order to sell its products. Japan made an effort to search for and understand foreign standards and exported products with such standards. For example, Japan manufactured and exported industrial products under UK standards to Singapore and Malaysia during the 1950s and 1960s and under US standards to the US during the 1970s and 1980s (ex. left-hand drive cars). However, Japan never thought of nor attempted to export Japanese standards.

Japanese manufacturers are capable and skilled enough to produce products to any standard. However this has proven to be a weak point. In the present discussion on standards for terrestrial digital TV, Japanese TV set manufactures are said to be reluctant to introduce the Japanese standard. Standards do not matter to them because their priority is to sell their products, as many as possible, whatever the technical standard. Meanwhile, China has now developed its own policy. It has embarked on a course to introduce its own standard for terrestrial digital TV (as explained later). This begs the point: How can Japan win without a clearly defined strategy? Two such international standards failures for Japan are illustrated here.

4.1. Failure Case Studies

Notorious failures for Japan were the ISO 9,000 and ISO 14,000 Series (Jou [2001]). Japan did not take the initiative in the ISO discussions though Japan was a leader in these fields.

ISO 9,000 Series

The ISO set up a Technical Committee (known as TC176) to discuss quality management and quality assurance. Canada was named to be the shepherd country and the first meeting was held at Ottawa in 1980. The major standards on ISO 9,000 Series were determined based on the British Standards (BS5750) in 1987. The Japanese government did not send any mission to the first meeting. Yet, up to date quality management was Japan's pride at that time as exemplified by quality control (QC) and the Deming Prize (Kagami [1995]), but Japan did not take any initiative in the discussion.

It came as a bolt from the blue to Japan when European clients asked to see ISO 9,000 certificates for products made in Japan during the 1990s. Since then Japanese manufacturers and exporters have had to obtain these certificates. Moreover Japan's need for acquisition of this series increased after 1997, when the government decided to require such certification as a condition of tender for government procurements.

ISO 14,000 Series

Following an environment summit held in Rio de Janeiro in 1992 the United Nations Committee on Environment and Development (UNCED) asked ISO to formulate system standards on the environment. The ISO established a Technical Committee (TC207), and the first meeting was held in Toronto in 1993. Five major standards on ISO 14,000 Series were stipulated in 1996. The core of these standards it is said, were promoted by the UK, based on its own standard (BS7750).

Here again, Japan failed to take any positive initiative in the discussion although Japan had extensive experience in environmental management. It is ironic that Japan's certificate acquisition number on this ISO series is number one in the world. This passive attitude shown by Japan in the arena of world discussion certainly undermined its position in global trade and investment, resulting in a worsening of its reputation internationally.

5. TECHNOLOGY AND SATISFACTION

The relationship between technology and consumer satisfaction is here analyzed from a different angle. Why do some products remain after alternative products appear? Substitutes are not always substitutes but sometimes act as complements or coexist. The evolution of products depends on technological advance and changes in consumers' preferences. This is why tipping takes place. Several cases of coexistence and disappearance are illustrated as follows:

5.1. Coexistence

Letter vs. Telephone

Writing letters is an old means of communication. People write letters to each other to communicate what they want to tell or know, for example, how they are getting along, their daily affairs, love affairs, commercial

transactions, and official uses. During the Edo era a professional group of *hikyaku* carried letters on foot. It took six days between Tokyo and Kyoto. Under the Meiji government official mail services began in 1871 first between Tokyo-Kyoto-Osaka. The introduction of telephone services in 1890, first between Tokyo and Yokohama, started 14 years after the invention of the telephone by Graham Bell in 1876. Telephone messages have several features such as (i) verbal communications, (ii) transmission is far quicker than mail, and (iii) no preparation is necessary such as in writing letters.

Both above methods of communication continue to exist today because of their own strengths. Letters, especially, are superior as a means of expressing personal affection and the human touch. Moreover, business and official letters are often important due to authentication and verification of signatures or official seals/emblems. Even facsimile or electronic letters are no substitute for written letters so far. The telephone is quick but is usually followed by a letter of confirmation in business practice. (This may be improved if electronic signature and identification systems are developed in e-business.)

Radio vs. Television

NHK (Japan Broadcasting Corporation, a public broadcasting organization and formerly called Tokyo Broadcasting Station) first broadcast radio programs in 1925 in Japan. NHK was then established as a special corporation in 1950. Private radio broadcasting stations started operating in 1951 and NHK started FM broadcasting in 1957. On the other hand, NHK started experimental black and white TV broadcasting in 1950 and began TV programs in the Tokyo metropolitan area in 1953. NHK color TV broadcasting started in 1960. In developing countries, for example, Brazil started color TV programs in 1972. The Football World Cup held in Argentina in 1978 boosted sales of color TVs in Brazil.

The introduction of TVs did not wipe out radio receivers because there are many radio lovers such as long-distance drivers, students working late at night and music fans, particularly, of high fidelity sound. Local radio stations also play an important role for community information. Here again, coexistence can be observed because people have their own taste for both services. In Japan terrestrial TV enterprises now number 129 and AM radio operators 48 and FM operators 194 (Ministry of Public Management, Home Affairs, Posts and Telecommunications [2001]).

Technological changes, however, kill some products. Functions and price are the main reasons for their failure.

5.2. Disappearance

Typewriter vs. Word processors/PCs

The first typewriter machine made by E. Remington & Sons went on sale in 1874. Since then typewriters have worked hard for almost 100 years. People mastered strangely arranged keyboards (QWERTY)³ and how to type became a must-skill for office workers. However, the appearance of the word processor, especially since the 1980s, drastically changed the situation. Word processors or PCs have editing and memory functions. This is the key element why typewriter machines have been almost completely forgotten. Only the keyboard function remains as standard in the word processor/PC as a remnant of the old technology.

Mainframe computer vs. PCs

Another example can be illustrated in computers. People were surprised to see the initial IBM computer systems. A solemn mainframe computer with card and magnetic tape reader machines enshrined in an air-conditioned room. The systems seemed to be almighty, virtual magic. Then came the PC. At first slow and expensive, PCs have gradually become powerful and cheap. They can easily be connected to create LAN systems, and once such networks are formed, PCs can function on equal terms with the old mainframe system. In addition PCs can be bought and mastered to an acceptable extent by individuals and used at home as well as work due to their relatively inexpensive purchase price and easy application systems. Now large mainframe computers only exist in the fields of large and high-speed calculation such as meteorology, astronomy, and quantum physics. IBM's history of glory, collapse and recovery shows even a giant can fail if market conditions (people's demand) and technological innovation are not well matched.

5.3. Consumer's Preference

It is summarized that good products remain even when there are alternatives because people's tastes differ while bad products disappear due to limited functions and cost considerations. Here people's tastes and personal inclinations are of importance because individual participation

becomes very crucial in the Internet world. That is why the change from the batch computer system to the PC is symbolic. It highlighted the end of centralized information systems and the birth of decentralized network information systems reflecting the changing attitudes and perceptions of contemporary society.

High-tech products are sometimes too high-tech. People do not want to deal with overly complex equipment or too sophisticated contents. PC manuals are still difficult to read. Multifunctional equipment with a high price tag all too often does not correspond with consumers who want simple functions. Sometimes IT machines seem to exist for themselves, not for users (In this respect, see, for example, Naemura [1995]).

By the same token government-engaged projects sometimes forget what the public want. Overinvestment or investment under misguided demand will cause disaster later. For example, in Japan NTT heavily invested in integrated services digital network (ISDN) but the service was basically ignored by consumers due to its slowness compared to new technologies such as DSL (Digital Subscriber Line) or ADSL (Asymmetric Digital Subscriber Line) in the broadband diffusion. Another failure in Japan is NHK's efforts to invent analog-type high-definition TV. Key factors here are technological changes, timing, and interpreting changes in user demand and taste.

6. CONVERGENCE OF TECHNOLOGY

The introduction of terrestrial digital TV broadcasting is in a heated state of discussion in several countries. Here the pros and cons of digital TV are explained. Especially, the convergence of TV and PC is discussed.

6.1. Analog vs. Digital TV

The invention of the digital TV method (DigiCipher) in the US in 1990 was a great step forward. There was a long dispute in the US during the 1990s regarding high definition TV (HDTV) or advanced TV (ATV). Digital TV finally won out against the analog-type in the Federal Communications Commission (FCC) discussion because of the invention of DigiCipher. NHK developed HDTV along analog lines but failed to be selected in this discussion (Hamano and Hattori [2001]). It is said that as a point of national strategy the US disliked the idea of Japanese dominance in the analog-type HDTV and thus made efforts to find new stan-

dards, i.e. digital TV methods.

Digital TV has the following merits over analog TV:

- (i) clear and beautiful pictures;
- (ii) two-way communications are possible (users can ask and get information through TVs);
- (iii) efficient use of frequency⁴ (multi-channels, no ghost, mobile telecommunications for vacant spectrum, etc.);
- (iv) TV receivers can be used as a PC due to digitization.⁵

On the other hand, digital TV has several difficulties to overcome as follows:

- (i) digital TV sets are very expensive and analog receivers need adapters called set top boxes (STB);
- (ii) broadcasting stations need to change equipment for digital TV transmission (enormous investments are required);
- (iii) demarcation of satellite broadcasting and CATV stations;
- (iv) content issues (uncertainty about digital content, while consumers question the need for HDTV as analog content continues to be popular).

In the UK, terrestrial digital TV started in September 1998 and satellite digital broadcasting in October 1998. The UK plans to transfer to digital TV by 2010. In the US, digital services started through satellite in June 1994 and through terrestrial stations in November 1998. While the FCC decided that all private TV stations must begin digital broadcasting by 2002. So far the progress of digital TV is slow. The purchase of digital TV sets in the US accumulated is barely over 1 million as compared with yearly purchases of analog TVs of 25 million sets. One of the reasons for the slow development of digital TV is that CATV's share in the US is as high as 68 percent, but CATV stations have not transmitted digital programs instead of conventional analog programs. It is now being discussed as to whether CATV stations must carry digital programs (a must-carry regulation). From the consumer's point of view, the content versus cost argument of digital TV is not very attractive owing to the very expensive price tag of digital TV sets. In a sense consumers are now in a wait-and-see mode.

6.2. Development of Digital TV in Japan

Satellite digital broadcasting began in June 1996 under the Communication Satellite (CS).⁶ At present two stations are functioning:

Sky-perfecTV and Wire Broad Networks. NHK started digital services under the Broadcasting Satellite (BS) in December 2000. Now BS digital services include 8 TV companies (three channels for NHK plus one for each of the 7 private companies), 10 private FM radio companies and 9 private data service companies. In addition a new satellite was fixed at the east longitude 110° in 2000 to operate CS/BS digital services from early 2002. CATV started digital services in July 1998 and began re-transmission of BS digital programs from December 2000.

With respect to terrestrial digital TV, services for three areas (Tokyo, Nagoya and Osaka) will start in 2003 and other areas in 2006. All analog-type broadcasting is planned to end by 2011 (Amendment of the Electric Wave Act in July 2001). In the meantime CATV has to be fully digitized by 2010.

This may create confusion among consumers. The reasons are as follows: (i) the diffusion of digital TV sets is slow like in the US. As of April 2001 BS digital TV sets shipped accumulated to 203,000 and digital tuners to 402,000 sets (Ministry of Public Management, Home Affairs, Posts and Telecommunications [2001]). Prices for this equipment is high⁷ and content not so attractive (such as baseball and golf); (ii) TV stations cannot prepare for digital services within such a short time in terms of money⁸ and programming; (iii) the end-date of analog services is too soon. Digital services may not cover all areas (universal service); (iv) it is thought that frequency allocation is under pressure from mobile telephone companies or other sectors which want to expand their services. People do not want to buy high-priced digital TVs in order to help consumer electronic companies nor cellular phone companies.

6.3. Unknown Factors: Interest Groups, Technology, and Demand

When we think of the future of digital TV, there exist unknown factors. First, there are severe conflicts of interest between interest groups such as CATV groups, satellite TV groups, other broadcasting stations, computer industry, TV manufacturers, mobile phone companies, multinational corporations (MNCs), and new entrants who are interested in multimedia and entertainment.⁹ Long-lasting discussions in the US on digital TV show that the dispute has not yet been resolved.

Second, technology will produce cheaper methods of TV transmission. For example, a flying object in a fixed orbit at 20,000 meters may work as a relay station. Actually, Honda and Cranfield University (UK),

are developing such an airplane (called 'space bird').¹⁰ They estimate that the cost will be one-hundredth of that of a satellite launch. Moreover, as we have seen so often in recent years, new technologies may come up in the TV-related field not only to reduce costs quickly but also to change concepts fundamentally.

Third, a reasonably large number of consumers may remain satisfied with their present analog TVs for quite a while to come and digital TVs may not diffuse as originally planned. Convergence of TV sets and PCs may not occur simply because people prefer to keep separate various functions such as PC use for private e-mail contacts while wide-screen digital TV sets may become popular for comfortable living room family relaxation. People's tastes and preferences are difficult to predict.

6.4. Digital TV Standards

It is understood that convergence takes place when the same technical standards are adopted by two different products, i.e., TVs and PCs, in the above case. Liquid crystal displays (LCDs) can now receive TV programs and LCDs are also used for PCs. Therefore, digital technology can soon attain convergence of TVs and PCs if standards are integrated.

At present there are four types of digital TV standards (see Table 3.1). NHK mainly developed the Integrated Services Digital Broadcasting-Terrestrial (ISDB-T) method, based on the US (ATSC) and European (DVB-T) methods. That is why ISDB-T is more flexible than the previous two methods. It is said, however, that the Chinese method (DMB-T) is better than the Japanese method in terms of mobile reception and data reception. China has a clear strategy that technical dependence is not permissible. China wants to develop its own standards for third-generation cellular phones, too, called TD-SCDMA against W-CDMA (Japan-Europe) and cdma2000 (US).

Brazil announced that it would start terrestrial digital TV broadcasting from 2002. NHK is eager to introduce the ISDB-T method because if Brazil adopts the system, there is an expectation that it will spread to other Mercosur countries and later South America as a whole. However, Japanese TV makers are said to be reluctant to push the idea. Standards do not matter for them to sell digital TV sets since they can correspond to any type of standard. Because Europeans are also enthusiastic to introduce their method, competition seems very tough.

Table 3.1: Digital TV Standards

Country	US	Europe	Japan	China
Name of Methods	ATSC	DVB-T	ISDB-T (Integrated Services Digital Broadcasting - Terrestrial)	DMB-T
Modulation	Single carrier (8-VSB)	Multi carrier (OFDM)	Multi carrier (OFDM = Orthogonal Frequency Division Multiplex)	Multi carrier & spread spectrum
Data rate in Mbps	19.4	5 to 32	4.9 to 23.2	5.4 to 32
Mobile reception	No	Some	Good	Best
Synch & channel equal	Time Domain	Freq Domain	Freq Domain	Time/Freq Domain
Power consumption	TV	TV	TV	Port TV & PDAs
Burst data reception	No	No	No	Yes

Source: 01/29/01 EE Times.

7. CONCLUDING REMARKS

Tipping takes place when consumer preferences change, especially changes in function, price and technical standards. Tipping may be slow if a converter exists between two different standards.

Technical standards have basically three categories: de facto standards, forum standards and de jure standards. De facto standards are the result of competition. Consumers decide the popularity of products. Thus, tipping is related to de facto standards. Moreover, network externalities that work in the present online networks produce the one-got-all phenomena. Group efforts by manufacturers bring about forum standards that can avoid losses and risks that come from severe competition through de facto standards. De jure standards come from public or international organizations to regulate and harmonize public and international concerns. We should utilize these standards according to consumer satisfaction, market conditions, product characteristics, product cycles, social as well as global systems.

Determination of new standards should be free from the egoism of advanced countries or MNCs because they have a tendency to reign over markets. Particularly, international standards should be transparent and neutral.¹¹

Japan has always followed foreign standards in order to export its products. Japan has never taken initiatives in standard discussions up until quite recently. Japan was forced to adopt European or US standards as global ones on several important occasions. Since Japan's technical levels and management skills are satisfactory as compared with those of other advanced countries, Japan should contribute more to international standard formations.¹²

The IT revolution has brought about tremendous impacts on our society (Kagami [2001]). These impacts are continuing both positively as well as negatively. Digitization of TV broadcasting networks is expected to make another major push because such TVs can be utilized as PCs: interactive communications, the Internet, games, T-business, and e-mail functions. Convergence of telecommunications and broadcasting requires fundamental adjustments in infrastructure, hardware, software, and content. Moreover, strategic alliances of firms including MNCs will take place and legal structure will also need to change.

Individual participation and people's demands, tastes or human touch (hand-written, voice and face-to-face contacts) are the key to this trans-

formation. Strong initiatives from governments or large firms will often fail since supply-side approaches always ignore changes in human satisfaction or future necessities. Aggressive supply plans for new products will be balanced with shifting demand. Moreover, technological changes are very quick. Development plans for top-of-the-line, state-of-the-art products such as digital HDTVs should be cautious, especially when huge income disparities exist in a society.

Convergence in IT-related products means that technical standards merge in different-purpose products. This will create tremendous welfare for mankind. However, consumer's choice does not change if the new products do not respond to its preferences or tastes.

Notes

* ISO defines standards as follows: Standards are documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit to their purpose.

¹ In order to produce DVD video for movies and DVD for PCs the forum worked well but standards for DVD for other purposes failed to integrate due to participants' different interests such as DVD-RAM. At present, three different types of DVD-RAM standards exist.

² ARIB is designated by MPHPT as the Center for Promotion of Efficient Use of the Radio Spectrum under the terms of Article 102-17 of the Radio Law of Japan. ARIB and its committees conduct studies, research and development, and standardization activities on radio systems to encourage high-density use of radio spectrum. ARIB also cooperates with similar standards groups around the world in seeking to harmonize standards for radio systems (<http://www.arib.or.jp/>).

³ The QWERTY keyboard is also said to be another example of tipping against the DVORAK keyboard (Katz and Shapiro [1994]).

⁴ One digital bandwidth can transmit three to four channels of standard TV programs due to the compressed technology of digitization. Also digitization can solve the ghost and noise problems usual on analog frequency caused by interference by electric waves. If analog TV broadcasts cease, the frequencies can be utilized for other uses such as mobile phones. An auction system for the allocation of bandwidth for wireless services is a new topic of conversation (Nakamura [2001]).

⁵ If digital TV uses the progressive method in scanning lines, it is more compatible with computer algorithm than interlaced scanning.

⁶ The World Radio Communication Conference 1977 allocated eight channels

on the orbit passing at the east longitude 110° for Japan. Now Japan has 2 BS satellites (BSAT-1a and BSAT-2a at 110°) and 4 CS satellites (JCSAT-4A at 124°, JCSAT-3 at 128°, SUPERBIRD-C at 144°, and JCSAT-2 at 154°). ITU has recently allowed Japan to have another satellite at 110° and it was launched in October, 2000 for CS uses. But due to the same longitude positioning as BS it can be used for CS/BS digital broadcasting probably from the beginning of 2002.

⁷ Initially the retail price of a digital TV set was more than US\$10,000 and now it costs around US\$3,500 (but still high compared with standard color TVs around US\$800).

⁸ It is said that the necessary investment in digitization for all analog stations is estimated at around US\$8.3 billion. Moreover, there is another problem relating to the frequency allocation. Digital TVs use the UHF band but some Japanese analog TVs are also using part of this UHF band so that a rearrangement of bandwidth is necessary for simultaneous broadcasting of analog and digital TVs (so-called analog-to-analog conversion problem). This investment was initially estimated to cost US\$606 million but recent estimations put the cost at over US\$1.6 billion due to wider affected receivers than previously expected (*Nihon Keizai Shimbun*, November 21, 2001).

⁹ In the UK, satellite B-Sky-B (digital) TV has reached 5.5 million households and CATV reached around 3 million since its start in 1998 while terrestrial digital TV (ITV Digital) is sluggish to 1.2 million as of September, 2001. The success of B-Sky-B is attributable to the distribution of free antenna and free STBs and a gamble on the lure of interactive services (*Nihon Keizai Shimbun*, November 26, 2001).

¹⁰ NASA succeeded to establish a height record of 29,400 meters for an unmanned airplane powered by solar battery on August 13, 2001 (called 'helios') (*Nihon Keizai Shimbun*, August 9, and August 14, 2001).

¹¹ Sometimes standards formation is done by public subscription for fairness. A new standard for encryption algorithms (called the Advanced Encryption Standard or AES) for US government use was offered by public subscription and a method invented by two Belgians was chosen in 1997, called 'Rijndael' (*Nihon Keizai Shimbun*, December 31, 2001).

¹² Japan is said to be advanced in the area of DVDs, cellular phones, game software, ceramics, nanotechnology and biotechnology.

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