

How the paper industry in Japan has technologically responded to the paradigm shifts of the Japanese society

Part 4: The Paper Industry in the 2000s --- A Paradigm Shift in Society

Kiyoaki Iida, Former Executive Director, JAPAN TAPPI

Introduction

The paper industry, which survived the crisis of the 1970s, struggled to find technology the industry should take in the 1990s. Then, in the 2000s it faced a drastic social paradigm shift. The chapter of this issue starts from 4 due to consecutive numbering. References cited also are in consecutive numbering from Part 1.

4. Paradigm shift in society and the paper industry after 2000

4.1 Reduction in demand and groping for key technology

In his sky-line analysis, Yoshikawa, following his remark on economy between 1990 and 1995, explained one after 1995 as below⁵⁵⁾.

1995-2000: Heisei depression became severer in the latter half of the 1990s, and it was called "The lost ten years". Further on, a serious financial crisis was experienced. ----- The sector of manufacturing industries was still in negative growth. Among the tertiary industry, wholesale and retail, real estate, transport and telecommunication fell into negative in addition to construction. Only service industry kept positive at that time.

2000-2005: Though GDP turned to be positive after 2003 in a real money base, the growth of nominal GDP was only 0.3% per five years. That was quite a new experience for the Japanese economy after the war. All industries including manufacturing sector, except finance and insurance, real estate, and services, fell into a negative growth. How were other countries? In the USA, though its grouping of industries was different from that of Japan, the sector for finance and real estate took over the top spot from the sector for manufacturing, mining and energy in the latter half of the 1980s. The UK did the same in the latter half of the 1990s, and German did so in the first half of the 1990s.

In Japan, on the other hand, the sector for finance and insurance and real estate which barely recovered from the financial crisis, could not become a leading sector. It was the service sector of a narrow sense, excluding finance, which led the economy.

As seen in the trend of GDP growth, discussed before, the paradigm of society fundamentally shifted in the latter half of the 1990s, which influenced paper and paperboard consumptions⁶²⁾.

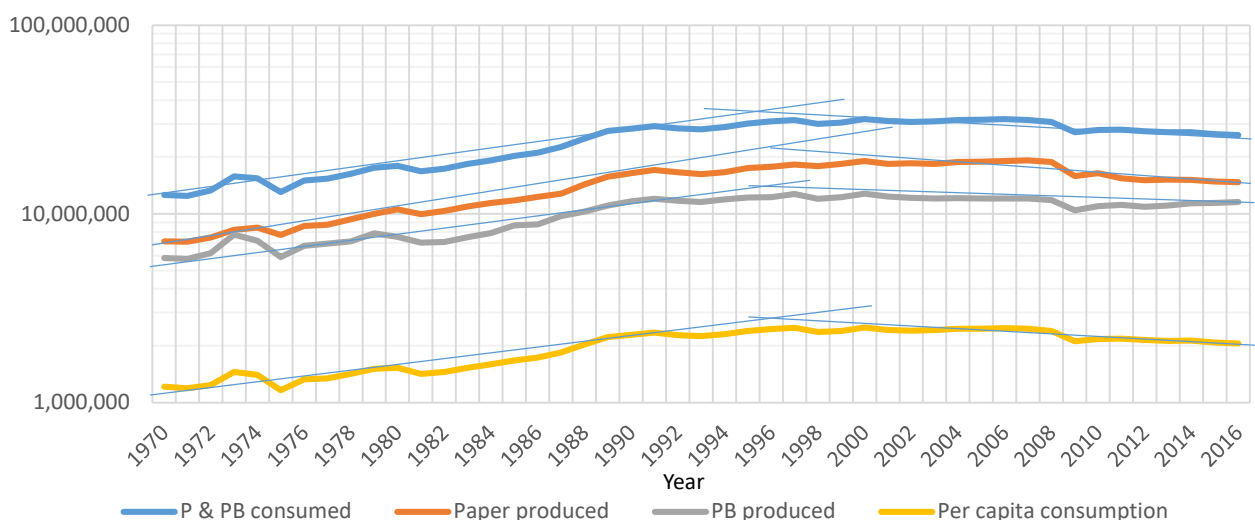


Fig. 30 Paper and Paperboard, and Per capita consumption

Paper and Paperboard: unit thousand tons, Per capita consumption: unit is the unit is kg/person
Each figure is multiplied by 10,000 and plotted in the Fig. 30.

Fig. 30 is for paper and paperboard consumed, paper produced, paperboard produced, and per capita consumption. Its y-axis is logarithmic. The per capita consumption is multiplied by 10⁴ and is plotted in Fig. 30. As we are interested in growth rate per year, multiplying by 10⁴ does not affect growth rate. Each set of plotted data can be approximated to two different linear line segments, the year around 1997 being a turning point, of which gradient represents a yearly growth rate during that period. They are summarized in Table 10.

Table 10 Yearly rates of change, paper and paperboard, and per capita consumption

	1970-1997	1997-2016
Paper & Paperboard consumed	3.5	-1.1
Paper produced	1970-1998	1998-2016
	3.7	-3.1
Paperboard produced	1970-1994	1994-2016
	3.1	0.0
Per capita consumption	1970-1998	1998-2016
	3.4	-2.2

The annual change rate of the per capita consumption turned to be negative at around 1995, and that of the total paper and paperboard consumption was in the same way. Looking data from a production side, the paperboard production was barely maintaining and the paper production greatly decreased. This transition which occurred in the latter half of the 1990s was a first experience for the paper industry, and corresponded to the shift of Japanese economy, mentioned by Yoshikawa, in which only the tertiary industry barely maintained growth. Then, how the paper industry dealt with the shift.

JAPAN TAPPI has an annual conference every year and its president who is a chief executive in charge of technology of a large paper company makes a key-note address. Let me review their addresses after 2000 to see how the industry reacted.

In 2002, Kintsuka addressed as follows ⁶³⁻¹. "The paper industry is aiming to be a completely recycling industry and working initiatively on projects helping to preserve global environment such as afforesting overseas, using recycled fiber and improving energy efficiency.

Regarding internationalization, competition with

imported paper products have already occurred ----- The textile industry, once prosperous, is down, and the steel industry has also been chased by Korean one. ---- The paper industry should have a sense of emergency to make our products competitive in the world." His sense of crisis was a little different from that in the 1970s, but was still against imported products, and far less serious than that of Yoshikawa who was an economist.

Kanamaru addressed in 2007 as follows ⁶³⁻². "We share the basic understanding that the production peaked in 2000 with the output of 31.83 million tons, and is now in a maturity stage.

However, A3 grade and light-weight coated grade are still increasing their volume of sales ----- We expect moderate growths in those categories hereafter. As the Japanese paper and paperboard market is being integrated in to Asian market, the industry has to improve its international competitiveness as fast as possible by improving productivity, reducing production cost and advancing new technologies. In this situation, four big paper companies announced to install their own paper machines respectively. It is a good chance for us engineers to take away technological frustration we have had for many large paper machines installed overseas for which China was a main player. ----- It is also a chance of developing new technology in operating newly installed paper machines of our own with which we will be able to lead the world once again. We would like to have strong support from suppliers of goods such as chemicals, paper machine accessories and instrument, and so on."

The essence of his speech is what was mentioned in the 1990s, and his key concept was installing new paper machines, making use of new technology, competing against imported products and cooperating with suppliers. For Kanamaru who experienced rushing installation of paper machines in the 1960s and the 1970s, the 2000s were certainly a period of technological frustration

In 2011, Kondo referred to the decline of paper and paperboard production volume and commented as follows ⁶³⁻³. "Especially information paper reduced its output by 21% against that in 2008 as its users have become less interested in paper media due to rapid progress of IT (Information Technology)." Then, he listed problems the industry had to deal with.

(1) Improving cost competitiveness: imported products are invading the domestic market, as they have been refined in quality with overwhelmingly low cost by using up-to-date technology.

(2) Developing new products: little growth of volume is expected in paper and paperboard business.

(3) Promoting countermeasures to global warming: the industry, following the voluntary guide line of itself, reduced the unit fossil fuel energy consumption to 77.8% of that in 1990,

(4) Passing technical ability and skill to next generation: with retirement of mill workers which is in sight, automation, out sourcing and few large investments will deteriorate ability of manufacturing."

Following is a keynote address by Koseki in 2016⁶³⁻⁴⁾. "The business will recover gradually. Paperboard will increase its output mostly in food category. Paper, on the other hand, will lose market due to the shift to electronic media. So, the volume of paper and paperboard production will be down by 1.2% against the previous year. The negative growth rate has continued for six consecutive years."

Finally, it was recognized in the paper industry that the paradigm shift of society reduced paper consumption. There was, however, little sense of crisis which had been shared in the industry of the 1970s. Though overseas ventures were discussed, few projects were going on. The business situation in which paper was losing market and paperboard was increasing its output, slightly though, was not so oppressing, as the industry switched fiber source from wood to recycled paper. Paradoxically, the declining demand for paper released the industry from historical obsession of being unable to get enough wood fiber for increasing demand. The industry controlled environmental problems fairly well. No one insisted that paper industry was not welcomed in Japan. Contrarily, the industry was ecologically evaluated for maintaining forest and fixing carbon. In those conditions, technological development did not work as a spring board so much as in the 1970s in which the industry had faced the crisis of existence.

4.2 Surge in digital information

The paper industry was struggling with decrease in

consumption and could not find a key-technology that will replace old one. Then, there came into being a new system of digitally transferring and storing information which decisively influenced paper consumption. The Japanese case being as example, the surge of digital information is reviewed.

Early in the 1960s, the Japanese government regarded it important to classify information by types of media and measured their volumes. The Ministry of Posts and Telecommunications, a part of the present The Ministry of Internal Affairs and Communications, collected the statistics on distributed volume of information every year since 1965. The data was published as the Census on the Distribution of Information until 2006⁶⁴⁻¹⁾. Its procedure is as follows. Media devices were classified in to three categories, telecommunications, transportable media and direct or verbal communications. The category of telecommunications included telephone, radio, TV, Internet, ETC and so on. The transportable were newsprint, books, printed matters, CD and DVD and so on. The direct communications included education, movies, sport, conversation, conferences and so on. Each information was converted to the volume of the unit called "word" by using defined exchange ratios. Some examples were as below.

Letter written: 0.22 words per letter

Letter spoken: 71 words per letter

Still image: 80 words per sheet

TV: 672 words per min.

Movie: 1032 words per min.

By adding every information as "word", the volume of information distributed and that of information consumed in a year were counted⁶⁴⁻²⁾.

The Census on the Distribution of Information was revised in 1992, and four new kinds of information were defined, information original, information dispatched, information supplied and information consumed, instead of old two kinds, information distributed and information consumed.

The information originally produced was dispatched. The dispatched information was copied and supplied. For instance, information was dispatched from TV stations, and TVs all over the country could receive all programs as information supplied. The original of publication and music was copied and supplied as books and records. A movie

(original) was on screen and supplied. Among information, one really read or watched was information consumed. The Census was restructured to the Index on Information Distribution in 2008, which will be discussed later.

The data were summarized in Figures 31-1, 31-2 and 31-3.

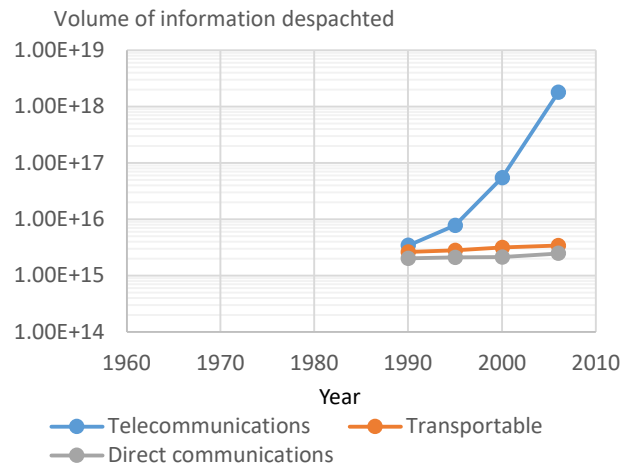


Fig.31-1 Volume of information dispatched

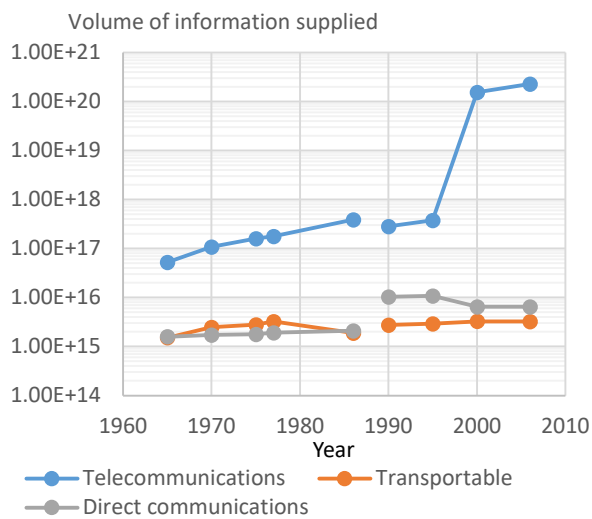


Fig. 31-2 Volume of information supplied

Figures depicted how much share the transportable, paper being one of them, had taken in the whole information volume since 1965. In about 1965, a main media of the transportable was probably paper. Its volume consumed, however, was already less than one tenth of either the telecommunications or the direct communications which were competing each other in the volume. Paper was already out of leading post. The three increased their volume consumed gradually almost with the same yearly rate. Then, the telecommunications leaped up in

around 1990. In the period of 10 years from 1995, its volume consumed increased hundredfold, equivalent to a yearly growth rate of 58%. It suggested that the society had really changed in quality. The transportable, paper being one of them, increased fairly at a yearly rate of 20%. The fact is studied in details.

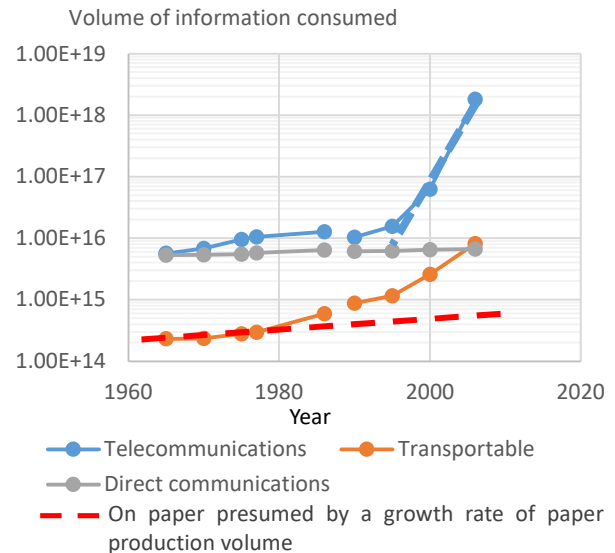


Fig. 31-3 Volume of information consumed

In the 1960s, recording devices of the transportable were paper and magnetic tape. Then, two devices, solid-state memory and HDD, rapidly became widespread due to their sharp and continuous price decline.

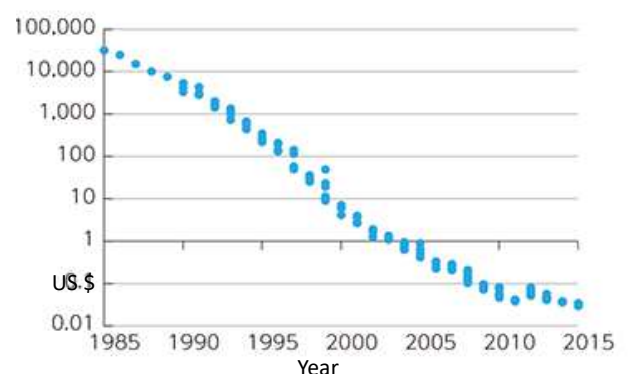


Fig. 32 Price decline of HDD

Fig. 32 depicts the decline of HDD price per GB. It is quoted from the 2015 version of The White Paper on Information and Communications, and its original was in <http://www.jcmit.com/mem2015.htm>, though not accessible now. The yearly decline rate from 1985 to 2015 was calculated to be about 40%.

The White Paper also cited the price decline of DIMM, one of solid-state memory, and its yearly decline rate from 1985 to 2015 was also calculated to be about 40%.

It means that the price was less than one 100th in ten years and was less than one 10000th in 20 years. Paper, on the other hand, kept almost the same price. Deservedly, information was recorded in low price devices. Then, information recorded in those devices such as soft wares in personal computers was frequently retrieved. That resulted in the fair increase of information consumed of the transportable after 1980. Information recorded on paper, on the other hand, which would have shared most of all at 1960, would increase at a yearly rate of about 3%, which was equivalent to the increase rate of the volume of paper manufactured. This rate of increase was plotted with red dashed line as comparison in Fig. 31-3. So, the fair increase of the transportable after 1990 was due to digital data frequently retrieved in computers. Judging from two lines in Fig. 31-3, one for the transportable and the other for paper production, the share of information on paper at 2006 was less than one tenth of the transportable.

Then, Internet became widespread since 2000, and the information consumed on it was classified to the teleconnections, the volume of which exploded.

Based on the data by the Census, information consumed on paper was less than one tenth of that of the transportable and was less than one thousandth of the total information consumed at around 2010. It is really discouraging to paper industry indeed.

Ministry of Public Management, Home Affairs, Posts and Telecommunications changed the Census to a new system, the Index on Information Distribution, in 2007, and revised data down to 2001 with the new system⁶⁴⁻¹). It may be because that the Census may not represent real information distribution, as the volume of information of the communications surged exponentially. The Index was also suspended in 2009, due to probably the surge of information called big data, which will be discussed later.

The difference between the Census and the Index is in counting the volume of information consumed. In the Census, information supplied and information

consumed were counted with the same conversion ratios. When information consumed was counted, symbolic information (characters and still images) was counted with its unit base and one kanji character was 0.3 "word". Moving image was counted with time base, and one minute of TV was 612 "word". Then, software in personal computer by being retrieved shared most of the transportable consumed, and it looked unrealistic.

In the Index, information distributed and Information consumed were counted with the same conversion system of the Census. Information consumed was counted with time base regardless of types of media. Visual information (printed matters and packaged software) was 223bps, auditory information was 105 bps, and visual-auditory information was 328 bps. The types of media were more finely classified. This new index covered years backward to 2001 and finished at 2009. The sudden withdrawal at 2009 might be due to further explosion of digital data, especially one called big data which will be discussed later in this paper.

Followings are from data of the year 2009 in the Index. Fig. 33-1 is for volume of information by types of devices.

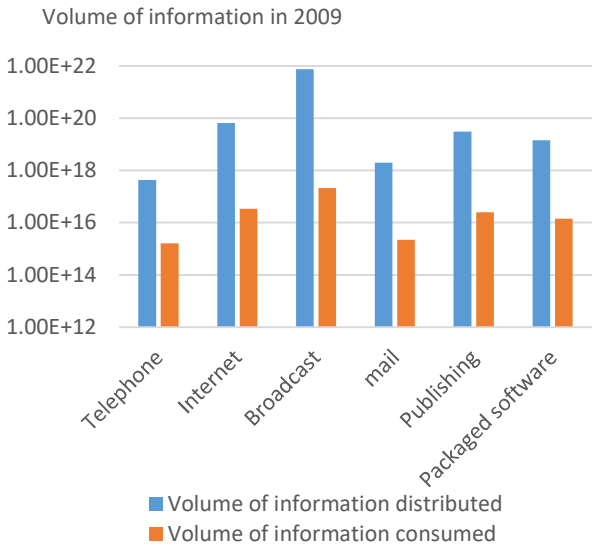


Fig. 33-1 Volume of information by types of devices in 2009

Let us classify the media devices to two categories like in the old Census, the telecommunications and the transportable, telephone and internet belonging to the telecommunications, and post, printing and publishing and packaged soft belonging to the

transportable. Then, Fig. 33-2 and Fig. 33-3 are obtained.

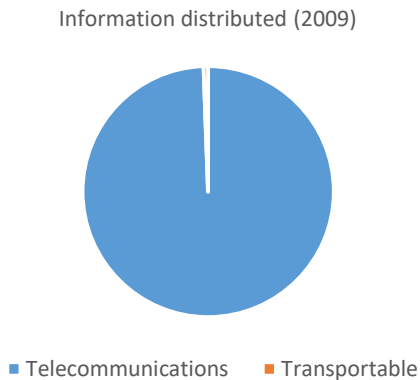


Fig. 33-2 Volume of information by categories, distributed in 2009

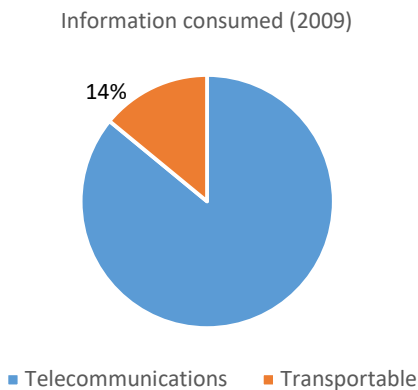


Fig. 33-3 Volume of information by categories, consumed in 2009

Though the transportable shared less than 1% in the distributed volume, its share in the consumed was as large as 14%, still significant indeed.

The yearly volumes distributed from 2001 to 2009 are presented in Fig. 34-1, and Fig. 34-2 is for volumes consumed.

Comparing data of the Census to those of the Index in details, the information distributed in the Census increased sharply from 1995, while the total information distributed in the Index increased not so rapidly as in the Census (Fig. 31-2). The information consumed in the Census (Fig. 31-3) also surged from 1995, while the total information consumed in the Index was rather steady. As there may be a limit to the volume of information man can receive, the data of the Index looks more reasonable. Using data in the Index, the yearly growth rate of the information distributed is calculated as usual, and summarized in

Table 12.

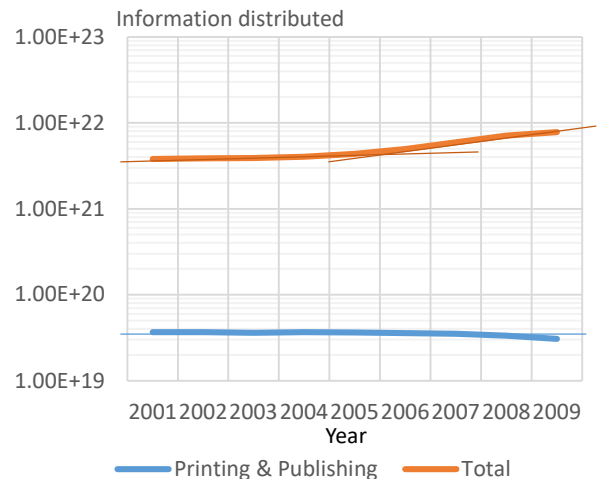


Fig. 34-1 Volume of information distributed

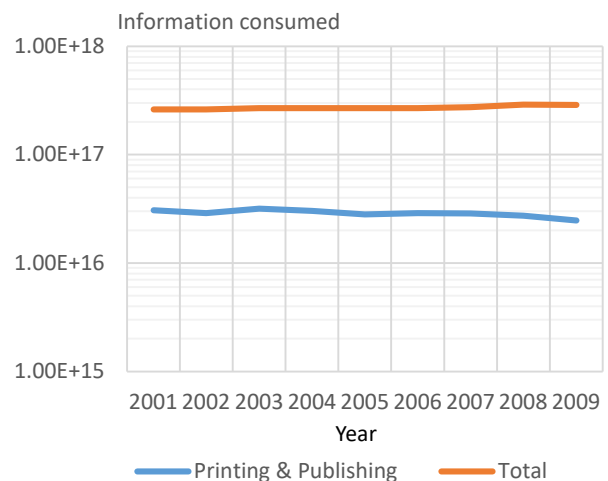


Fig. 34-2 Volume of information consumed

Table 12 Yearly change rate of the information distributed (%)
(Table 11 is deleted.)

	2001-2005	2005-2009
Total	4.1	18.9
Printing & publishing		-2.6

Though GDP was stagnated between 2000 and 2005, the information distributed grew at the rate of 4% per year. Then, 2005 as a turning year, it accelerated its increase rate. On the other hand, the volume of information by printing and publishing was gradually decreasing. The decrease corresponded to one observed in the consumption of paper (newsprint and printing paper.)

The increase of digital data since 2005 is reviewed more in details as follows.

Recently, the type of data called big data is surging

in volume, and the Index, not to say the Census, cannot measure its volume of distribution correctly. Then, the Ministry of Public Management, Home Affairs, Posts and Telecommunications reported a survey on its volume of distribution in 2014, using economic censuses, and questionnaires and hearings to corporations⁶⁵⁾. Analogue data were not interested and not counted in the survey. It started at 2005 and ended at 2013. The drastic growth of its volume is depicted in Fig. 34-3. The annual growth rates are calculated as before, and summarized in Table 13.

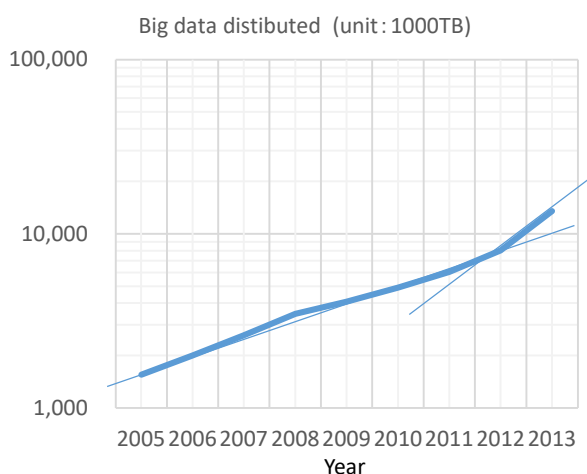


Fig. 34-3 Volume of big data distributed

Table 13 Annual growth rates of the volume of big data distributed (%)

	2001-2011	2011-2013
Big data	25.8	70.0

The growth rates were unbelievable and especially one after 2011. It may still be accelerating at present.

So, it is understood that the decline of paper consumption after 2005 is not due to sluggish economy, but due to the paradigm shift of Japanese society. The year of 2005 may be a turning point of technology, called singularity, and Japan has been in a world of different dimension since 2012.

In the next issue, paper and paper board production in the world will be reviewed. Besides, the technological effort of the paper industry in Japan in the 2010s will be followed.

References

- 55) H. Yoshikawa and S. Miyakawa: Shift in Industrial Structure and Japanese Economy after World War II
RIETIDiscussionPaperSeries09-J-024
<http://www.rieti.go.jp/jp>
- 62) Prepared from Yearbook of Pulp and Paper Statistics by the MITI and Paper Recycling Handbook by Paper Recycling Promotion Center
- 63-1) Akira Kinzuka: JAPANTAPPI Journal Vol.56, No.1, p.9 (2002)
- 63-2) Yoshihiro Kanamaru: JAPANTAPPI Journal Vol.61, No.1, p.9 (2007)
- 63-3) Shinichiro Kondo: JAPANTAPPI Journal Vol.65, No.1, p.9 (2011)
- 63-4) Yoshiki Koseki: JAPANTAPPI Journal Vol.71, No.1, p.10 (2017)
- 64-1) Ministry of Public Management, Home Affairs, Posts and Telecommunications : The census on the distribution of information, the database on statistics of information distribution
http://www.soumu.go.jp/johotsusintokei/link/link03_02.html
- 64-2) Kiyooki Iida: Survey on Technologies Developed in Communication Paper Production in Japan p.14, Center of the History of Industrial technology, National Museum of Nature and Science (August, 2012)
- 64-3) Ministry of Public Management, Home Affairs, Posts and Telecommunications : The index on the distribution of information, (2010)
http://www.soumu.go.jp/menu_news/s-news/01iicp01_01000004.html
- 65) Ministry of Public Management, Home Affairs, Posts and Telecommunications: Study on measuring the volume of information in the age of big data, (2014)
www.soumu.go.jp/johotsusintokei/linkdata/h26_05_houkoku.pdf