

## Japanese paper Industry after the Meiji Restoration: How technology helped its growth Part 1: Society that wanted machine made paper called YOSHI

Kiyooki Iida, Former Executive Director, JAPAN TAPPI

### 1. Introduction

After reviewing the history of paper manufacturing in the world, how paper manufacturing in Japan progressed was interesting.

There were cases in the world in which imported paper from Europe, which was precedent in manufacturing technology, threatened domestic paper making in some regions. Islamic world accepted paper making from China and transferred it to Europe in the 11th century. Egypt and Syria had prosperous paper industry of their own. Then, in the 15th century European paper of which cost was reduced by improving productivity invaded Islamic market<sup>1)</sup>. Egypt lost the competition and became just a depot for Islamic market. Persia (Iran) which manufactured paper of fine quality in the 14th century and was a center of Islamic culture till the 16th century stagnated in technology and lost market to European paper. In the 19th century, Russian and Indian which installed European paper machines also exported products to Iran<sup>1)</sup>.

Competition among vast regions asking a product of better quality and lower price lasted for generations. Paper itself experienced it against

bamboo slips, papyrus and parchment, taking long time to replace.

America, on the other hand, positively accepted European technology, which was developed in the Industrial Revolution, copied equipment by itself, nurtured the industry, refined equipment by adding its own development, and became a leader in the world. Its way of introducing technology was quite smart. In the 1800s, there was already communication established between Europe and America. Information was well exchanged, and the patent system was enacted on the same standard. Cylinder machine was a good example. As Dickinson, Englishman, who invented a cylinder machine, did not apply the patent to keep it secret, a copy was made in America, bringing parts from England. It spread more quickly than in England. Then, with know-how gained in machining, paper machine of Fourdrinier model, which Donkin had developed and was selling in Europe, was also domestically made, though some time later<sup>2)</sup>.

So, how did Japan do? Fig. 1 symbolically depicts the progress of Japanese paper industry.

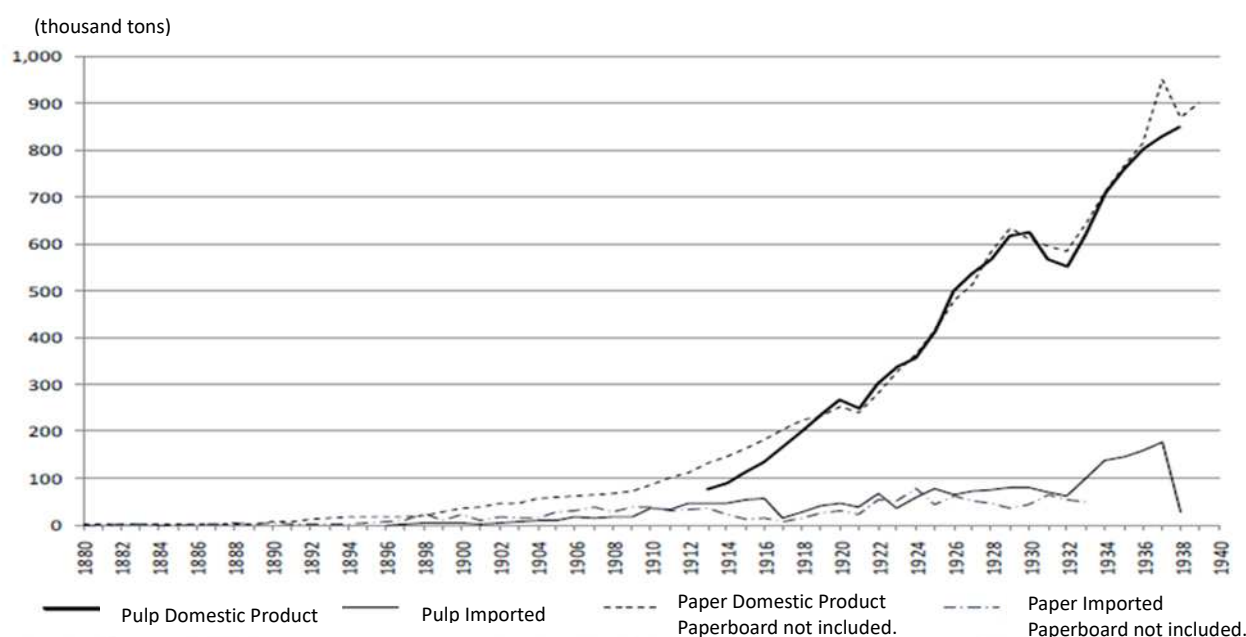


Fig. 1 Output volumes (thousand tons) per year in Japan from 1880 to 1940

Fig. 1 is a work by Yamaguchi prepared from statistics in various documents<sup>3)</sup>. Japanese Paper industry took off at around 1905. It took more than 30 years since it imported a first paper machine in 1872.

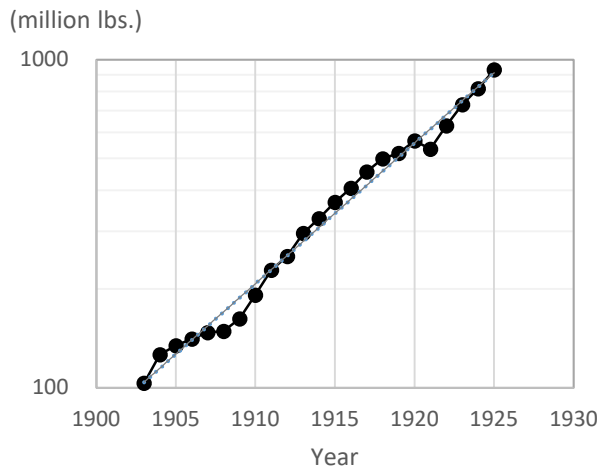


Fig. 2 Amount of YOSHI produced, prepared from the reference<sup>4)</sup>

Fig. 2 depicted the amount of YOSHI, machine-made paper and paperboard, produced (WASHI, traditional Japanese paper, was not included). Though YOSHI will be defined later in Chapter 2, it was a counter name to WASHI, and included types of paper and paperboard asked by society changing its structure since the Meiji Restoration. YOSHI increased outputs and grew to be an origin of Japanese pulp and paper industry. The unit was million pounds and the y-axis was in a logarithmic scale. During the period between 1903 and 1925, the plotted dots formed almost a linear line, which meant that the production volume increased at the same rate per year. When calculated, it was astonishingly 10% per year. For reference, the output in 1940 was 2.25 times that in 1925, which corresponded to an annual growth rate of about 6%, which was still big.

Then, how much did Japanese society grew in that period? Its GDP is taken as an index. There is available a data base called Maddison Project Data Base, which started work since 2010, led by Angus Maddison. It compiles historical per capita GDP, on a country basis, with help from professionals of those countries. The data are based on dollar at 1990 and an effect of inflation is excluded<sup>5)</sup>.

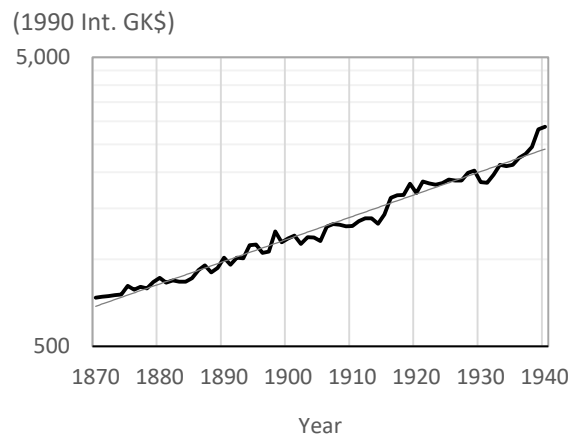


Fig. 3 per capita GDP, based on US dollars in 1990

Fig. 3 is per capita GDP of Japan. As the y-axis is logarithmic, and the data can be approximated to a linear line segment, the average growth rate per year can be calculated and it is 1.7%. The size of population increased from 35 million in 1870 to 75 million in 1940. With these figures, GDP at 1870 and that at 1940 are calculated. The latter is 6.42 times the former, which is equivalent to an annual growth rate of about 3%. While GDP increased at a rate of 3% per year, paper and paperboard production (WASHI excluded) increased at a rate of 10 to 6%. In other words, paper was supplied with a larger pace than the growth of Japanese society. It is said that paper consumption is strongly correlated to GDP, and there are such cases<sup>6)</sup>. When society expanded dynamically, mostly observed in the beginning of its growth, the growth of paper consumption exceeded that of GDP growth, and that happened in Japan as well.

The increasing demand was created by two rapidly spreading markets, printing that used paper and packaging (carton boxes) that used paperboard. The Ministry of Agriculture and Commerce began to collect statistics, and its first report at 1885 (Statistics of Agriculture and Commerce) listed amounts of paper products, mostly WASHI and a small amount of YOSHI. Printing was not listed in it, which meant that printing was not regarded an industry yet.

Then, the other statistics report (Statistics on Products Manufactured in Mills) which was interested in industrial products began in 1909, in which printing was as large as paper in money basis in 1909. In the statistics of 1930, the volume of printing and bookmaking was 11 times that of 1909, and the volume of paper was 9 times that of 1909.

Though paper production increased a lot, printing grew faster than paper, suggesting that active demand by printing was pulling paper production. It also suggested that Japanese society was civilizing quickly with vigorous volume of printed matters.

The paper industry in Japan worked hard to supply enough for the active demand. While supplying to the demand, the industry developed a business model of its own, which was securing wood resource, constructing integrated mills and competing imported products. This concept was passed on even after the war, and Japan was the second largest producer in the world in the 1990s. The steady supply of paper by the industry helped civilize Japanese society and contributed to its progress. In this paper, the history of technological development in the paper industry from 1868, the beginning of the Meiji era, to 1945, the end of the World War II, will be reviewed.

## **2. Society that wanted YOSHI: printing and packaging**

### **2.1 Demand by printing**

The culture in Europe and America, their lifestyle in other words, was introduced into Japan after the Meiji Restoration. It asked new types of paper, called YOSHI, which meant "Western paper" in Japanese and was a counter name to WASHI. Then, what is YOSHI? There are several definitions differentiating YOSHI from WASHI, and most of them are by the process of manufacturing. It would be better to focus on ways paper is used and to define YOSHI as paper requested by the new lifestyle.

Focusing on uses, there were differences between the new lifestyle and traditional Japanese one in two categories. One category was printing. Before the Meiji Restoration, wood block printing was used in Japan, whereas Europe and America already used letterpress printing. The other was packaging and the newly introduced lifestyle asked carton and corrugated boxes, new commodities in Japanese society. So, the paper industry in the Meiji era wanted to make and supply YOSHI to those two emerging markets.

Firstly, its relationship with printing is reviewed. Historically, paper preceded printing. In Japan, however, printing asked paper to be manufactured. The history of printing is excerpted from the website

of Japan Federation of Printing Industry <sup>7)</sup>.

Letterpress printing spread quickly in the Japanese society since the beginning of the Meiji (1868). The first newspaper was published in 1870, and many others followed. In the first 10 years, 3,600 books were published by letterpress. The Meiji government promoted letterpress printing as one of means of "modernizing society".

Followings are paper-related topics such as the launch of a newspaper, excerpted from the history book of Oji Paper Co. <sup>8)</sup>.

- 1870 "Yokohamamainichi-shinbun"(newspaper) launched
- 1872 "Tokyonichinichi-shinbun"(newspaper) launched
- 1874 Post stamp began to use YOSHI
- 1874 "Yomiuri-shinbun" (newspaper) launched
- 1876 "Osaka-nippo" (newspaper) launched
- 1877 Joined in the Universal Post Union
- 1879 "Osakaasahi-sinbun" (newspaper) launched
- 1881 "Jichi-shinpo" (newspaper) launched
- 1887 Tokyo YOSHI Dealer Union established
- 1890 "Kokumin-shinbun" (newspaper) launched
- 1890 A rotary printing press for newsprint imported

Then, how big was the printing industry, and how much volume of paper did the paper industry supplied?

The Ministry of Agriculture and Commerce published statistics (Agriculture and Commerce Table, abbreviated as ACT in this paper) on commodities produced in a year, in volume as well as money base, since 1884. In the table of 1884, paper, WASHI and YOSHI, were listed and few industrial products were there, suggesting that they were in infancy yet. Regarding printing, it was not included even in the table of 1909.

Then, the other statistics report (Statistics on Products Manufactured in Mills, abbreviated as SPMM in this paper) which covered industrial products began in 1909, in which printing abruptly appeared. Paper was listed in a group of chemicals. Their data in 1909 were summarized in Table 1, along with that of paper in Agriculture and Commerce Table (ATC).

Table 1 Product outputs in 1909 (unit: yen)

SPMM* <sup>1</sup> , Group 5, 1909	
Printing	15,698,458
Bookmaking	394,598
Paper products	2,265,159
SPMM* <sup>1</sup> , Group 3, 1909	
WASHI	5,158,067
YOSHI	12,486,156
ACT* <sup>2</sup> , 1909	
WASHI	18,218,549
YOSHI	14,159,329

\*1: Statistics on Products Manufactured in Mills

\*2: Agriculture and Commerce Table

In 1909, the printing industry was as large as the paper industry in money base. Regarding paper, its output in money base was quite different from that in the Agriculture and Commerce Table. The SPMM was based on self-reports from mills which employed more than 5 persons, while ACT collected data by itself. Please have a look at each WASHI column. The figure in SPMM was far less than that in ATC. It meant that WASHI was manufactured mostly in homes of less than 5 employees, not in mills yet, in 1909<sup>9)</sup>.

Their data of 1930 in SPMM was in Table 2. The classification between WASHI and YOSHI disappeared, as YOSHI probably became a major and had replaced most of WASHI output.

Table 2 Product outputs in 1930 (unit: yen)

SPMM* <sup>1</sup> , 1930	
Paper total	154,574,144
Printing & Bookmaking	179,564,248
Paper products	25,605,146

\*1: Statistics on Products Manufactured in Mills

Comparing data of 1930 to those of 1909, the printing and bookmaking became 11 times that of 1909, and paper became 9 times as large. Their growth rates were similar each other. It might be said that the increasing demand in printing asked to expand paper production. One symbolic event was that school textbook was printed on YOSHI, replacing WASHI, in 1906.

In the course of transition from WASHI to YOSHI, imported paper became a competitor. How much share did it take?

Foreign trade statistics were published since 1890.

Table 3 Paper imported in money base (unit: yen)

Year	
1890	571,897
1913	4,721,988

Table 4 Paper produced in money base (unit: yen)

ACT* <sup>2</sup> , 1890	
YOSHI total	403,441
WASHI total	4,750,000
SPMM* <sup>1</sup> 1914	
Paper total	28,611,659
ACT* <sup>2</sup> 1914	
YOSHI	23,000,000
WASHI	21,000,000

\*1: Statistics on Products Manufactured in Mills

\*2: Agriculture and Commerce Table

In 1890, fifteen years since YOSHI-making started, an amount of paper imported was larger than that of YOSHI manufactured. In 1913-1914, 40 years since YOSHI making began, an amount of paper imported was 8 times that in 1890, whereas an amount of paper manufactured was 60 times that in 1890. The share of the imported was about 20% of the domestically manufactured at around 1913. The paper industry became competitive to imported products in 40 years. From that time on, as in Fig. 1, it kept supplying to growing demand in the domestic market.

## 2.2 Demand by carton boxes

The other category was packaging, specifically carton boxes and corrugated boxes. They were introduced to Japan after the Meiji Restoration and changed Japanese society. The Patent Office posts a public document on the history of paper carton<sup>10)</sup>.

Table 5 Chronology of paperboard development

1856	Corrugated board invented in England
1869	Paperboard imported into Japan
1873	A front cover of a book by Noya
1874	A box for medicine by Inoue
1882	Double faced corrugated board
1906	Corrugated box was recognized for transport in the U.S.
1909	

	The business of corrugated box began in Japan. It was named "DAN-BORU"
1911	Paper carton was made in Japan as business.

Japan Paper-box and Corrugated-box Industry Association introduced how paper box production began in Japan in its website as follows <sup>11)</sup>. "In 1881, a merchant in Nihonbashi, Tokyo, imported paperboard and began to make paper boxes. Then, the demand for boxes grew as food (candy, egg and laver) and commodities (soap and clothes) began to be packed. Osaka district also started the business, and there were 120 converters, employing 350 craftsmen in 1892. Paperboard was mostly imported, and about 200 tons were consumed in Tokyo area and 500 tons in Osaka area. The output of boxes was about 450 thousand yen."

Carton boxes were steadily accepted, and the business was growing to factory system from home industry. Tokyo Paper Box Co. wrote in its website as follows <sup>12)</sup>. "In 1910, Tajima visited an exhibition in London, and saw kinds of paper products. He established a company in 1911, which is still in business now."

How was an amount of the business? Carton box was probably classified into paper products in Tables 1, and 2. Though its amount was 15% of that of printing and 17% of that of paper, it was growing steadily from 1909 to 1930. The statistics of paperboard production in SPMM is reviewed more in details and summarized in Table 6.

Table 6 Statistics: paperboard production

Paperboard	Production (lbs.)	Production (yen)
1914	52,581,177	1,208,131
		345,284
1919	175,046,938	10,793,207
		394,088
1920	173,611,244	13,185,933
1921	105,012,244	4,156,376
		174,270
1922	198,017,856	10,104,720
		51,332
1923	148,484,180	8,629,814

Though data fluctuated a little, the market was steadily growing. Matsumoto reviewed as follows <sup>13)</sup>. "When the World War I started, the demand for

paperboard sharply increased. One report said that not only domestic demand but also that for export to Asian market, which had traditionally imported from Europe, suddenly increased and Japanese suppliers became very busy. In fact, production increased rapidly after 1915, and the output in 1918 was about 141 million lbs. of which 22 million lbs. were exported. They were the biggest ever. In the late half of 1918, some paperboard makers recorded a dividend of more than 100%. Many paperboard companies began business in all over the country. It was like bamboo shoots after a rain fall."

The sharp increase in output volume from 1914 to 1919 in Table 6 was exactly what was described by Matsumoto. Furthermore, right at those days, domestic paper machine suppliers made a great leap forward, and delivered many cylinder machines which will be mentioned in a later chapter.

The fact that the demand for printing and packaging was increasing suggested that Japanese society was steadily expanding. In fact, as reviewed in Chapter 1, Japanese economy (GDP) grew at a rate of 3% per year. As society got richer, then more amount of paper was demanded. To meet the demand, paper machines were wanted. Domestic machine makers became able to deliver them. Then, paper was manufactured with less cost, which expanded market further. A positive spiral started, and economy grew.

To make a positive spiral going, the paper industry searched new wood resources one after another, and improved productivity. As a result, it could increase output at a yearly rate of 6 to 10%. Technology definitely helped make it, and it will be reviewed in following chapters.

## References

- 1) Kiyooki Iida: JAPAN TAPPI Journal Vol.69, No.4, p.66 (2015)
- 2) Kiyooki Iida: JAPAN TAPPI Journal Vol.68, No.6, p.38 (2014)
- 3) Asuka Yamaguchi: The market of pulp for papermaking in Japan before the World War II p.2, KEIO/KYOTO JOINT GLOBAL CENTER OF EXCELLENCE PROGRAM, KEIO/KYOTO GLOBAL COE DISCUSSION PAPER SERIES, DP2009-031 (2009)
- 4) Kazutoshi Maeda: YOSHI market in Meiji and

- Taisho eras p.4, Research Paper 16, 1-24, 1986-03-25, Faculty of Business Administration, Komazawa University
- 5) Maddison Project Database, [www.ggdc.net/maddison/](http://www.ggdc.net/maddison/)
  - 6) Kiyooki Iida: JAPAN TAPPI Journal Vol.70, No.3, p.69 (2016)
  - 7) The history of printing, Japan Federation of Printing Industries  
[http://www.jfpi.or.jp/printpia/part2\\_03-01.html](http://www.jfpi.or.jp/printpia/part2_03-01.html)
  - 8) Oji Paper Co.: Corporate history of Oji Paper Co. Appendix (Oct.,1959)
  - 9) Tetsuji Okazaki: Industrialization of Japan and industrial structure Chapter 2, CIRJE-J-210 (March, 2009)  
[http://www.e.u-tokyo.ac.jp/cirje/research/03research02dp\\_j.html](http://www.e.u-tokyo.ac.jp/cirje/research/03research02dp_j.html)
  - 10) The Patent Office, public document: Chronology of paperboard development
  - 11) Japan Paper-box and Corrugated-box Association  
<http://www.mmjp.or.jp/zenshiki/top.html>
  - 12) Tokyoshiki Co. Ltd  
[www.tokyoshiki.co.jp](http://www.tokyoshiki.co.jp)
  - 13) Kazuaki Matsumoto: Corporate entrepreneurship of Tokutaro Nakajima Part 2, Research Paper No.12, p.45 (July, 2014), Nagaoka University