

Japanese paper Industry after the Meiji Restoration: How technology helped its growth Part 6: WASHI industry and environmental concern

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Preface

After the Meiji Restoration, YOSHI, which was wanted and was imported into Japan, to enjoy new lifestyle, replaced WASHI, traditional paper used in old Japan. WASHI, however, tried to survive with technological innovations.

7. WASHI industry

7.1 WASHI industry before the Meiji Restoration

WASHI, traditional Japanese paper, was manufactured in districts all over Japan as an important marketable commodity before the Meiji Restoration.

It was described as follows ¹⁾.

"The Tokugawa shogunate promoted domestic industries, as it prohibited trades with foreign countries. WASHI production had been one of important businesses and feudal lords encouraged increasing the volume of production and strictly controlled the business as a way of getting a cash income. In the Edo period, WASHI was used not only for books and manuscripts but also as an elemental material for various applications in daily life. The

WASHI industry was a basic life-related industry."

Then, how much volume was produced? It was reported as follows ²⁾.

"Tosa WASHI, which was manufactured at Tosa (Current Kochi pref.), one of major manufacturing districts, was dealt at an Osaka market and its sales was about one million ryo a year in the later Edo period. One estimate said that it was almost the same to the income the Tosa domain collected as a tax from its territory."

How much was one ryo? It is not an easy question to answer. Using the rates estimated by Currency Museum, Bank of Japan ³⁾, the sum Tosa got would be 63 billion yen calculated based on the price of rice, and 322 billion yen based on the daily wage of a carpenter. In any cases, it was really a big money to Tosa.

Tosa was not exceptional, and many other feudal lords encouraged WASHI manufacturing at their selected sites. Surprisingly, most of those sites still remain in WASHI manufacturing business and sell products which bear their own old district names. They are shown in a map in Fig.1.

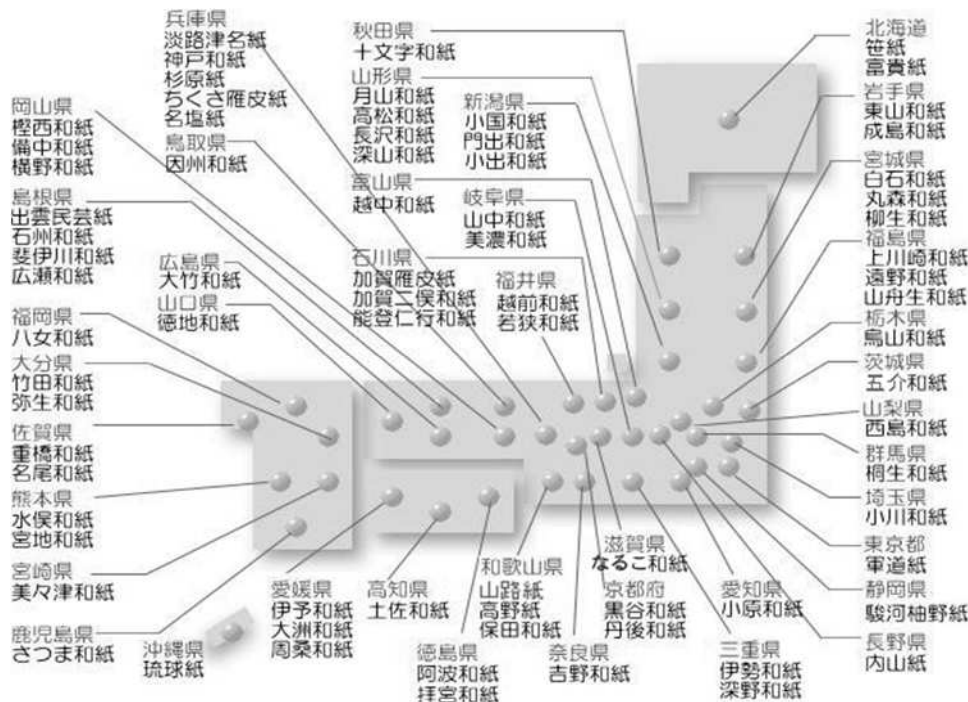


Fig 1 WASHI manufacturing sites at present days ⁴⁾

Japanese names are not translated, as the map (Fig. 1) is for showing there are still many manufacturing sites. They cover all over Japan, and some prefectures have several sites in themselves.

The production in the Edo period was carried out in a style of a typical cottage industry, and in some cases, farmers engaged in the production at their off-seasons. It was different from a factory model which was developed in Europe in the late 1700s. Several cases are introduced as follows from their web sites.

Tango-Futamata Kami ⁵⁾

The district was abundant with resource of good quality and Yura River supplied plentiful water. In the early Meiji period, about 1,100 families engaged in the production, as an off-season business.

WASHI making in Yamagata ⁶⁾

The feudal lord granted a privilege of paper making to 15 families, and their WASHI was used for formal manuscripts of the lord. Neighboring districts also expanded the production with help by the lord who was eager to nurture new businesses.

Yatsushiro Myaji Kami ⁷⁾

11 families manufactured paper specifically for the lord, and were supported with various kinds of privileges.

WASHI manufacturing in the Fuji district ⁸⁾

Paper manufacturing was very popular in mountain villages in the Fuji district. The product was delivered to Edo, and was famous like a brand item under the name of Suruga Hanshi. It was made of paperbush (mitsumata), and was soft in handling.

In the late 1700s, Europe made paper in a way which would progress to a factory system in the Industrial Revolution, though it was primitive yet. It is said that Robert invented the idea of paper machine, as he was annoyed by troubles with a union of workers in a mill. Japan, on the other hand, manufactured paper in a way almost same to one described in Englishiki in the 900s. It remained still a cottage industry.

As a sufficient volume of paper was supplied by diligent efforts of each feudal lords, publishing became prosperous in the Edo period. At the middle of the Edo period, a literacy rate was relatively high due to reading training at temples, and various kinds of books mostly printed by wood block plates were distributed. Ukiyoe was also one version printed by wood block ⁹⁾.

How many volumes of books were published in those days? It was discussed in a reference ¹⁰⁾. In the UK, the number of publications in a decade from 1790 was about 80 thousand. The number was increasing exponentially. In Japan, in a decade from 1850, sixty years later than in the UK, the number of publications was 30-40 thousand, one third of which were manuscripts. The data of the UK was overwhelming. But, taking into account that the UK was in the frontline of civilized countries, Japan at the Edo period was not so bad.

Printed matters in Edo, however, could not induce social reform in a scale which Europe had experienced. They were probably more expensive than those in Europe. Mulberry and paper bush were pounded to pulp stock by hand. Paper was hand-made in family business. Printing was by wood block. While in Europe, rags were stamped by power of water wheel. Paper machines were already in use. Jobs were organized in a factory. Printing was done by letterpress ⁹⁾.

7.2 Technological developments in the Meiji era

How did the yearly output of WASHI change after the Meiji Restoration? The first statistics on the output of each industry was published by the government in 1886 as the Statistics on Agriculture and Commerce Commodities ¹⁶⁾. It was 19 years after the Restoration. The paper industry was one of the listed industries, and WASHI shared most of the output of the paper sector. The other industries listed were fabric, tatami flooring, paper products, metal wares, China wares, lacquer wares, oil, and leather wares. Modern manufacturing industries were still in their infancy and were not listed yet. In the same statistics of 1909, many new modern manufacturing industries appeared, and the paper section had subcategories for WASHI and YOSHI. It looked that basic industrial structure was being in order in Japan at around 1909.

Fig. 2 is a work by Chikamori ¹¹⁾. It was prepared from the Statistics on Agriculture and Commerce Commodities ¹⁶⁾ published by the government. Followings would be concluded.

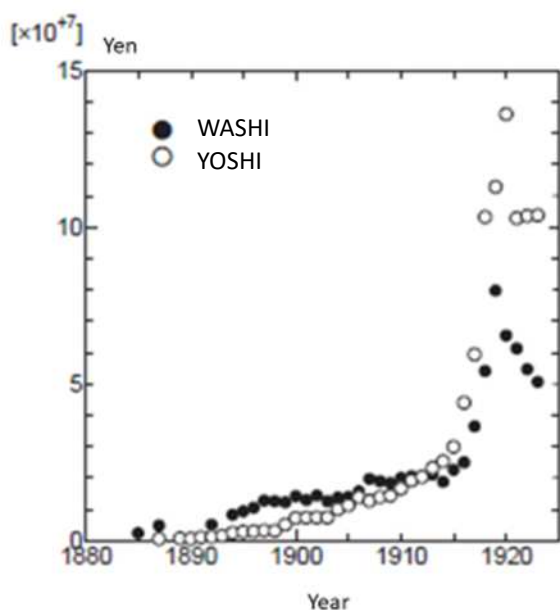


Fig. 2 Annual outputs (money base), WASHI and YOSHI

1. WASHI was increasing its output (money base) even in the early Meiji era. The sharp rise followed with the sudden reduction was due to special demands during World War I.
2. YOSHI started to increase its output at around 1900, made a sharp rise from 1915 and then exceeded WASHI in the output in a money base. The increase of the WASHI output from 1886 to 1915 suggested that the WASHI market still grew. The sharp rise from 1915 was contributed partly by inflation at those years.

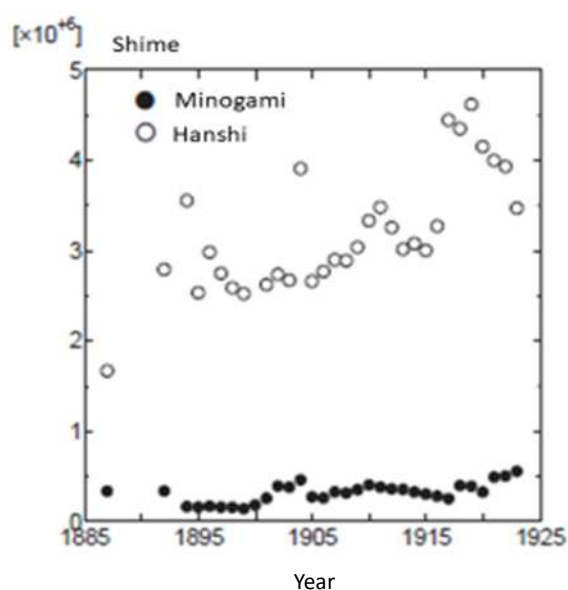


Fig. 3 Annual outputs counted by the number of sheets for two popular grades of WASHI

Fig. 3 suggested it. Chikamori picked up two major WASHI products, and made Fig. 3. Their output volumes counted by shime were in a slight growth. The shime was a term to count the number of sheets, like a ream. It, however, was amazing that WASHI remained being an important product for about 50 years since YOSHI manufacturing was imported into Japan. Why could it maintain its status?

As told before, some feudal lords were eager to nurture WASHI production and it was already an important business in some districts. After the Restoration, local governments which inherited the businesses supported them as before. For instance, the local government of Tosa constructed a railroad line from Ino, a main manufacturing district, to Kochi to help export business²⁾.

Surprisingly, the process of WASHI manufacturing itself was revolutionized in the early Meiji era. Kobayashi and Kobata introduced Genta Yoshii as an innovator in WASHI making in those years who symbolized the evolution^{12), 13)}. His work was summarized as follows.

1. Improvement in sheet making
Productivity was greatly improved by modifying a hand mold (sukiketa). By using clay as filler instead of rice powder, paper became resistant to paper worm.
2. Development of new kinds of paper and improvement of paper quality
As pen and ink were used in common, WASHI on which letters had been written with a writing brush (fude) and a Chinese ink (sumi) had to satisfy the quality asked by pen and ink. Yoshii added rosin at sheet forming.
As the post system was established nationwide, he developed a letter paper which was thin in thickness. Then, it was modified to copying paper for typewriter, which was exported in a large volume. His other paper products were waterproof paper, paper used for designing in ship building, draft paper of heavy thickness and et.al. He made more than 30 kinds of new products.
3. Promoting planting of fiber resources
4. Technology disclosure
He was open for those coming to learn from him. He was invited by many provincial governments to make presentation on his inventions.

In 1905, his dictation on papermaking was filed to a book entitled "Japanese Paper Making". It was a monumental handbook on WASHI making.

As restrictions by feudal lords disappeared, and free communication became possible in Meiji, WASHI technology made large progress, and his efforts represent what the WASHI industry tried to survive against incoming YOSHI. In some districts, WASHI industry changed from a cottage manufacturing to an organized one.

In spite of those efforts in the WASHI industry, it gradually lost such markets as office paper, book paper and letter paper to YOSHI. Then, the WASHI industry as a whole introduced cylinder machines to improve productivity. The product was called machine-formed WASHI. The first cylinder machine in the WASHI industry was installed in 1894 in Fuji city in Shizuoka. Harada Paper Co. operated a cylinder machine by turbine wheel, and produced napkins. Almost at the same time, cylinder machines were also introduced in Kochi, which had been famous for its WASHI of thin thickness, called Tengujiyou-paper, which was being exported to Europe and the US ¹⁴⁾. With cylinder machines, Tosa district could manufacture WASHI which was thin in thickness and good in quality in a large scale. It was successfully exported as a typewriter paper ²⁾.

How much was it exported? Table 1 is the statistics on import and export in 1890.

Table 1 Statistics on Import and export in 1890 ¹⁵⁾

[Export]		
	Destination	Yen
Gannpi-shi (Paper of extremely light weight)	The US	12,607
	The UK	11,543
	France	5,218
Subtotal		34,276
Yoshi-like paper		5,441
Wall paper	The UK	79,082
	The US	15,503
Subtotal		201,661
Other papers of light weight	The UK	14,700
	The US	10,588
Subtotal		114,904
Total		256,282
[Import]		
	Supplier	Yen
Yoshi papers	Germany	281,526
	The UK	253,779
	Belgium	25,246
	Austria	4,167
Total		571,897

Destinations of export were the US and the UK. Regarding import, suppliers to Japan were Germany and the UK. It was understandable that Germany was the largest paper producer in Europe in those days. The amount of the export in 1890 in a money base was about a half of that of the total import. WASHI was really doing well.

Table 2 is the statistics on import and export in 1912.

In 1912, the value of import was 4,721,988 yen, while that of export, excluding one to China, was 939,533 yen, which was still about 20 % of the total import. As one "kin" was supposed to be 600 grams, the amount of copy paper exported was about 350 tons, and that of napkin was about 174 tons.

A new lifestyle in the Meiji asked paper suitable to printing and paperboard for packaging in a large volume. Though WASHI worked hard to survive, it could not compete in those markets to domestically produced YOSHI, which was manufactured of wood pulp and on large paper machines.

In Table 2, there is a paper product named "Imitation Japanese paper". The episode on this paper is interesting, as it symbolized a relation among WASHI, YOSHI and domestically made YOSHI ¹⁷⁾.

A kind of WASHI manufactured in the Ministry of Finance was presented at Paris World Expo, and had a good reputation. It was used as paper on which the Treaty of Versailles was printed in 1919. Austrian paper makers were interested in the quality of that WASHI, and made paper of similar quality "Simili Japanese Vellum" with sulfite pulp in 1896. The product was imported into Japan as Imitation Japanese paper, as it was cheaper than the original WASHI. As the amount imported increased, Japanese paper makers (YOSHI manufactures) began manufacturing it domestically under the name of "mozoshi", which meant imitated paper ¹⁸⁾.

In spite of the efforts of improving productivity and exploring new markets, the WASHI could not survive. It was fatal that its fiber resources which were mulberry and paperbush were limited in volume. It, however, exploited a new category of product called functional paper and is still supplying important paper products, though the volume is not much.

Table 2 Statistics on Import and export in 1912 ¹⁵⁾

[Import]		
	"kin "	Yen
Pulp	76,904,983	4,379,861
[Suppliers]		
Germany	39,720,013	2,337,654
Sweden	25,111,016	1,367,364
Norway	7,399,194	430,604
The US	683,241	33,965
Papweboard	4,075,879	413,306
[Suppliers]		
Germany	2,471,828	262,545
Sweden	621,571	45,788
The US	538,020	65,345
Russia	16,667	816
Printing paper	27,312,713	2,958,623
[Suppliers]		
The UK	11,177,751	1,360,652
Germany	9,542,648	959,588
The US	1,057,934	120,574
Belgiun	3,623,335	361,470
Writing paper	2,850,308	465,224
[Suppliers]		
The UK	2,063,475	556,197
Austria	516,851	62,099
Germany	183,967	28,500
Imitation Japanese paper	12,597,254	1,298,141
[Suppliers]		
Germany	3,583,827	363,159
Belgiun	1,270,761	159,043
Austria	2,543,228	270,580
Sweden	1,948,580	184,899
Norway	1,754,177	167,737
Import total (pulp excluded)		4,721,988

[Export]		
	"kin"	Yen
Copy paper	578,368	431,970
[Destinations]		
The UK	179,680	131,562
Germany	50,633	36,759
The uS	252,439	175,658
Imitation YOSHI	4,935,531	510,869
[Destinations]		
Mostly to China and Manchuria		
Paper of light weight	1,290,764	509,042
[Destinations]		
Mostly to China and Manchuria		
Papers	360,550	120,257
[Destinations]		
Mostly to China and Manchuria		
Paper of light weight	352,196	272,782
[Destinations]		
Mostly to China and Manchuria		
The US	37,754	31,905
The UK	11,924	10,378
France	17,977	14,517
Paper napkin	290,521	234,781
[Destinations]		
The US	69,480	48,108
Canada	58,146	35,782
Austria	24,399	18,378
Export total		2,079,701
Export total (excluding China)		939,533

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8. Concerns to environmental pollution

Recently, corporations are impossible to do business without paying concerns to environment preservation. How did Japanese paper industry deal with environment? Until the 1970s, effluents from sulfite and groundwood pulp plants were discharged with little treatment. In sulfate pulp plant, waste liquor was recovered for regenerating chemicals, not for environmental concerns. It discharged dark effluent and emitted bad odor around. The industry became notorious for polluting environment. Increasing pulp output worsened the troubles. The industry paid a huge cost and somehow regained credibility in the 1980s.

How were environmental matters dealt before the World War II? Many persons, Nishi being one of them, presented their memoirs in JAPAN TAPPI Journal., most of which were written after 1960, when environmental problems were socially concerned. They, however, rarely mentioned on environmental matters of days their memories covered. Followings were picked up among them.

Nishi wrote a memoir of two pages entitled "memories on effluent treatment" ¹⁾. In 1910, he treated effluent from a machine section by sedimentation and recovered pulp stock. It, however, was to recover pulp stock economically, not to improve the effluent quality.

In 1936, a mill at Toyohara received a complaint saying that herring catch was declining. Then, it fermented its sulfite waste liquor, and recovered alcohol. The residue was dried and used as a sticky. After all, the volume of effluent was reduced and the complaint was cleared. The mill had five digesters and manufactured 51 thousand tons of pulp a year. Though it was one of the largest mills at that time, it was a small mill under a present standard ¹⁾.

Yoshitoshi reported on pollutions by sulfate pulp production in Ochiai Mill ²⁾. "An odor problem was really bad. But, most of residents were concerned with the company, and few complaints were raised."

"Mill effluent passed through only a sediment pond and was discharged. Salmon caught at a river mouth had an odor like sulfite waste liquor. Some compensation was made for the claim. Regarding effluent troubles, we received several guidelines from the Sakhalin municipal government and professors of Otaru Higher Commercial School"

"A loud noise from the mill was really bad. The big sound at a blow of kraft digesters roared in a town. It repeated 42 times a day, and surely disturbed sleep at nights. But, few complaints from a town." Ochiai Mill had a capacity of 36,200 tons for sulfite pulp and a capacity of 26,000 tons for kraft pulp. The kraft plant had 7 batch digesters. If one cooking cycle was 4 hours, it would blow 42 times a day. The sulfite plant had 4 digesters. The number of the blow per digester would be 1-2 times a day. It was a typical "corporate town" indeed.

Katayama retrospectively constructed a kraft pulp mill in Sakhalin. It consisted of a series of three articles. He did not comment anything on pollution. The capacity of the mill was: 40 thousand tons of rayon kraft pulp and 21 thousand tons of kraft pulp.

Though mills in Sakhalin definitely polluted environment, actual pollutions were not much concerned. It may be that the capacities of mills were relatively small and could be acceptable to environment. Furthermore, mill sites were not so populated.

After the World War II, the paper industry lost manufacturing capacities in Sakhalin. The demand for paper and paperboard, on the other hand, grew sharply. The industry increased manufacturing capacity in the mainland which was highly populated.

In 1952, a field survey on effluent from pulp and paper mills was carried out. The result of the survey was published in references 3) and 4). Though some troubles were reported, they were not so detrimental yet. Following data would suggest why it was so.

Annual output of paper and paperboard.

1940: 0.9 million tons

1952: 1.76 million tons

2000: 31.82 million tons ¹⁾

Then, in the 1970s, environmental pollutions became unbearable, and the industry spent a lot of money to clear the problems. With those efforts, the industry recovered social credibility and produced as

much as 32 million tons in 2000. The efforts are reviewed in the reference 5).

The next issue will be a summary of the series, and continuity from the Edo period will be discussed.

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