

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

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The summary of the series

1 Two paradigm shifts in the history after the World War II

When the annual output volume of one product is plotted against years in a graph, of which y-axis is in a logarithmic scale, a gradient at a certain year corresponds to its annual change rate. If plotted dots can be approximated to a straight-line segment for a certain period of years, it means that a change rate is almost constant for that period. The annual volume of paper and paperboard consumption of Japan is plotted in that way since 1950 to study its historical behavior. The consumption increased at a rate of 13.2% per year from 1950. Then, 1970-1975 as a turning period, the annual growth rate decreased to 3.8%. It became -0.9%, the period of 1995-2000 being as the second inflection. The nominal GDP of Japan behaved similarly. It increased at an annual rate of 14.5%, declined to 8.6% and then to 0.0%. It is understood that the economy and society of Japan experienced a big paradigm shift in each inflection period and the paper industry in Japan was affected as well.

2 The status of the paper industry in Japanese economy.

The share of the paper industry in Japanese economy was about 3% of the manufacturing sector, based on money, in 1960. The share has been maintained with some variance up to now. It is unique as most industries of Japan experienced big ups and downs. The industry has not been export-

oriented, and its export has been less than 10% of its output. Instead, it has secured domestic market against imported products, and the import has been less than 10% of the production.

While the Japanese economy experienced two big paradigm shifts, the paper industry kept its share in the economy. It is understood that technology has helped make it, which will be reviewed.

3 Crisis in the 1970s and technological solutions

In the first turning period of 1970-1975, oil price hiked, the Rome Club warned that resources on the earth were limited, and Japan suffered environment pollution induced by precedent uncontrolled economic developments. Then, public opinion changed from pro-development to being sustainable. The paper industry was unwelcomed to stay manufacturing in the country, being notorious for environment pollution it had induced by rapid expansion. The industry itself had a sense of crisis on its existence as wood price hiked and imported products became oppressive.

Regarding environment preservation, the industry invested more than 800 billion yen in five years, and notorious pollutions were controlled to acceptable levels. Regarding wood resources, successive developments, such as using hardwood, importing wood chips and promoting use of recycled fiber for newsprint, relieved oppressive wood shortage, and gave some prospect in the future.

The technology for manufacturing products was greatly innovated in those days. The key was making

use of solid state technology. Japan, in general, introduced it in its manufacturing processes ahead of other countries, improved productivity and product quality and won distinction in the world market. The paper industry vigorously invested in plant and equipment. Close cooperative relation with Japanese suppliers, who were licensees of technologies developed in overseas but were capable enough, refined its production technology to the highest level in the world. That made the paper industry competitive against imported products.

The oil price hike was a shock to the industry. Saving energy became a subject of all paper companies and the Japan Paper Association led the action. The total unit energy consumption, expressed as an index that was 100 in 1990, was reduced from 133 in 1983 to 92 in 1999. The ratio of energy purchased to total product sold, both based on money, was 19.5% in 1980. The ratio went down to 6.8% in 1993.

Against menace of imported products, domestic products demonstrated better cost performance. In the latter half of the 1960s, synthetic pulp and synthetic paper were interested and expected to have a share of about 20%. They, however, failed due to the oil price hike.

4. Some relief in the 90s and technological stalemate

As a result, the industry could technologically cope with difficulties such as environment pollution, scarce wood resource, energy price hike and offensive imported products, and achieved better profit than the average of other manufacturing industries. Furthermore, the industry was eco-friendly and was regarded sustainable.

In the 1980s, Japanese economy greatly reduced its growth rate. The demand for paper and paperboard became stagnated. Merging and restructuring among paper companies were progressed to be resilient. Distribution network was rationalized. Overseas ventures were promoted, but was not successful. The ratio of overseas sale to total sale of the paper industry, which was in the lowest among members of the manufacturing sector in the 1980s, was still in the lowest in 2002. The industry was still domestic-oriented. Though the demand was

decelerating, there was no alternative to paper in sight yet. The less demand rather removed some of oppression of wood supply needed. As an industry sustainable with high recycling rate, the paper industry enjoyed some relief from the crisis in the 70s.

In the 1990s, enlarging plant and equipment with improved productivity, which solid state technology had made possible and Japanese process industries had made the best use of, became stagnated. Moreover, the technology spread in the world and newcomers were catching up. Japan was groping for a new technology of candidate, but in vain.

5. Information Revolution and Information Society

Right at that time, a sign of technological revolution emerged, which would be called the Information Revolution and would replace one of functions of paper.

Since 1970, the per capita consumption of paper and paperboard still increased at an annual rate of 3.4%, though far less than that in precedent days. Then, it turned to be -2.2% at around 1995. The output also followed the trend, and turned to decline with an annual rate of -1.1% at around 1997. The industry had not experienced such declines yet. The world production, though some delay in time, started to level off at around 2007 as well.

On the other hand, the volume of information not based on paper drastically increased (probably a rate of over 50% per year) from around 1995. In 2009, it shared 99% of the total information distributed, and 87% of the total information consumed, which meant that the share by paper was only 13%. From around 2010, a type of digital data called big data came into use, and is increasing its volume at a rate of several tens of percent, probably more than 70%. In the period from 2000 to 2010, digital data caused a paradigm shift in Japanese society, and the new society is called the information society.

6. Search for a new business model

Though printing paper and newsprint are losing each market, paperboard and sanitary paper are increasing their outputs. The paper industry is looking for a new business model to deal with the social shift.