The Future of the Media Industries from an Asian Perspective

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For the people of Asia, the printing industry has maintained an important role in manufacturing which evolved from a rich cultural heritage. New technologies are driving the rapid dissemination of information globally. Notwithstanding, Chinese printing technology and papermaking are considered two of the most important inventions in human history, which continue to contribute to the development and progress of human civilization. As a result of Chinese economic reform, the printing industry is one of the fastest growing sectors in China. The effect of the steady growth of printing revenues occurring during 2004 to 2014 at an average annual rate of 17% per year, caused the size of printing industry to expand by as much four times its original size. Just like China has become the world's second largest economy, the printing industry in China has become a major market share leader with the second largest print market. Presently, the Chinese printing industry is experiencing environmental and market-related pressures–even though the developmental growth rate is slowing down, the size of industry is still showing signs of growth. To face these challenges, the printing industry should focus on Web integration, cross media integration, new developments in "environmentally green" functional print materials, intelligent or "smart" printing presses, and cleaner production technologies.

1. The Development of the Printing Industry in China

1.1 The Development Status

In the early 1980s, China's printing industry still used metal type composition machines as a source for printing while the European and American countries already employed the third generation of photocomposition systems. Professor Wang Xuan from the Beijing University led a research team to invent the Chinese character laser-photo-typesetting system that has led Chinese character printing into the electrical and digital age. It was known as the "second invention of Chinese printing characters." On May 8th, 1985, the Chinese self-designed computer - Laser editor's composing system and Xinhua News Agency's intermediate experiment project of Chinese character- had passed the country qualification. It allowed China's printing industry to skip the second/third generation and enter the fourth generation computer with laser photo-typesetting directly. Economic Daily News, printed on May 22nd, 1987, has become the first Chinese newspaper to print from the computerized laser phototypesetting system designed specifically for reproducing Chinese characters.

In the 1980s and 1990s, high-speed multi-color offset printing presses represented a breakthrough in the printing industry because of enhancements resulting from new technologies and innovations. Platemaking techniques have been improved and advanced ink-making techniques were developed in the early 21st century. Digital printing, Web-to-Print, and on-demand printing is growing rapidly because of the use of Internet technology and innovation of business model. After thirty years of efforts and development, China has become the major print media provider. The total value of business income of large-scale printing enterprises (annual output value is more than 50 million yuan) has increased from $306.26 billion to $657.95 billion from 2011 to 2014, with annual growth rate of 22%. Based on the statistics from 31 Provinces, there are 17 Provinces with an average growth rate of equal to or higher than the national growth rate of the overall printing industry.

According to the statistics from the State Administration of Press, Publication, Radio, Film and Television of the People's Republic of China, there are 105,000 domestic printing companies with a total of 3,394,000 employees in 2014. The output value is $1,085.75 billion; the total asset is $1,176.3 billion; the total profit is $71.42 billion; trade volume of external processing printing is $86.62 billion. There are 3,125 key printing companies, 50 more than the previous year. The output value has reached 54.2% of total output value nationwide. Large-scale printing companies are accounted for 5% of the printing industry.

In 2014, the top 100 domestic printing enterprises include 12 companies from the Pearl River Delta region, 47 companies from the Yangtze River Delta region, 12 companies from the circum-Bohai-sea, and 71 companies from the three major printing industrial belts.

Among them, 10 companies are engaged in publishing and printing, 58 companies are engaged in packaging printing, and 27 companies are engaged in hybrid printing. Those top 100 enterprises do not include printing material and equipment suppliers (paper, inks, flexible plastics, equipment and devices, etc.). The top 100 domestic printing enterprises also do not include leading companies for packaging (Jingia Group, Shantou Dongfeng Printing, Hucais Printing, HuangShan Nocel Co., etc.) and security printing.

Although the overall size of Chinese printing industry ranked second in the world, small and medium enterprises are the major parts of its industry structure. The numbers of small and medium enterprises are accounted for 90% of entire printing industry. The developments in different regions are unbalanced. The enterprises that actively integrate and implement technologies are located in the Pearl River Delta and the Yangtze River Delta regions. The companies located in the Midwest have relatively slow pace for corporate restructuring and upgrading.

1.2 The Development of Features in Print Media

The printing industry is expected to contract slightly due to the economic slowdown.

In his column at Whattheythink.com, a daily newsfeed sWith increasing market demand and rapid economic development, the output value of the printing industry in China was growing with an average double-digit rate since 1980s. Affected by the global economic environment and printing market, the growth rate of the printing industry has decreased from double-digit to single digit from the beginning of 2012. That is two consecutive years of decline. However, the average operating income increases as the numbers of companies decreased. Labor productivity also increased every year.

The growth of the global economy was weaker than expected in 2014. With economic uncertainty, the demand for print has been declining causing a reduction in the total number of companies and the number of employees. The operating costs of the printing industry continue to rise and the average profit continues to drop. The total output value grew 5.3%, slightly lower than the growth rate of the national economy.

From the global perspective, the output value of the global printing industry declined slightly from 2010 to 2014. Total print volume fell 0.1% every year. Because of China's huge population, the economy driven by consumer spending is significant. As long as there is the presence of economic activity there is need for print. The demand for print, especially in the digital printing and personalized printing areas, has a steady growth. Therefore, China's printing industry still has great potential for growth.

There is a significant advantage for the Economic Region

The regional development for packaging printing industry in China relies on economic development regions. Generally, economic development regions in China include the Pearl River Delta industrial belt centering on Guangdong, the Yangtze River Delta industrial belt surrounding Shanghai, Jiangsu, and Zhejiang, the circum-Bohai-sea industrial belt around Beijing, Tianjin, Hebei, and Shandong, northeast area, northwest area, and central region. The printing and packaging industry in the Yangtze River Delta industrial belt and the Pearl River Delta industrial belt are showing steady growth. These great locations attract businessmen from Hong Kong and Taiwan to construct printing plants in the Pearl River Delta industrial belt. The printing industry in Hong Kong moves toward north. Shenzhen not only attracts Hong Kong but also foreign investment. According to data, around two-thirds of foreign-funded enterprises have settled in the Pearl River Delta region. Driven by the strong regional economic growth, the printing industry in the Yangtze River Delta region has become the focus of world attention. According to statistics, the operating income of the printing companies located in Jiangsu, Zhejiang, and Shanghai is accounted for one-third of total operating income. The trade volume in these areas had increases of 16.2% in 2014, much higher than the growth rate of 2.9% nationwide. In the recent years, Kunshan in Jiangsu Province received numerous printing jobs from the International companies such as Microsoft, Apple, and Procter & Gamble. The Yangtze River Delta region provides high level of print service and is deeply integrated into the international industrial chain.

It is clear to see that the development in different regions is unbalanced. The printing and packaging industry in the central region and part of the western

region has greater development, while some of the printing and packaging companies located in the Pearl River Delta region and eastern coastal areas have begun to move to the Bohai Rim region and the Midwest area. The output value of the central region is up to $177.98 billion in 2014, with an increase rate of 11.1%. Its growth rate is greater than the circum-Bohai-sea industrial belt, the Yangtze River Delta industrial belt, and the Pearl River Delta industrial belt. The output value of the central region is accounted for one-third of total output value. The central region has become the new growth spot of industrial development. Highlights in the western region are Shaanxi Province and Sichuan Province. The output value of Shaanxi Province is $11.52 billion, with an increase rate of 9.9% (the same growth rate of GDP).

In the future, the printing industry should take advantages of the whole industry chain and promote coordinated development among different regions with technological progress and innovative business models. The printing industry in Beijing and Tianjin region will continue to focus on the aspects of publishing, printing, and printing equipment. The printing industry in the Yangtze River Delta industrial belt will concentrate on the packaging printing, international printing, and high quality printing. The printing industry in the Pearl River Delta industrial belt will work closely with Hong Kong, Macao, and Taiwan to enhance the technical level and competitiveness.

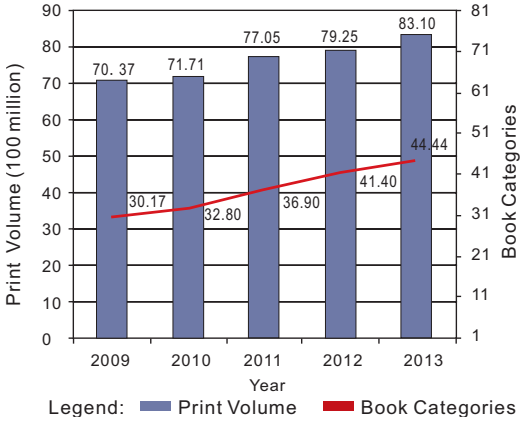

Figure 1: Statistics and data on book print volume, 2009-2013

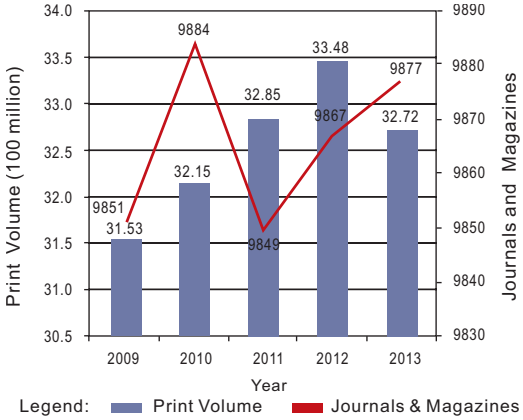

Figure 2: Statistics and data on journal/magazine print volume, 2009-2013

Book Print Volume is steadily increasing; Newsprint Volume has Negative Growth for Three Consecutive Years

From the standpoint of market and product development, book print volume is steadily increasing, while journal and magazine print volume has significantly decreased in 2013. There are several factors that need to be taken into account, which include society, economy, regional development of the publishing industry, education level, publishing benefits and national science and technology development direction, readers' demand, and the impact of digital media. Some printing companies have encountered operating difficulty. The print media industry is looking for industrial optimization, transformation/upgrading, and structural adjustment. Statistics and data on book and journal/magazine print volume from 2009 to 2013 are shown in Figure 1 and Figure 2.

A statistical analysis from the China Association of Newspapers, the statistical data collected from 150 newsprint companies shows that the newsprint volume in 2014 are 94.53 billion sheets, which accounted for 69.5% of total newsprint volume. The total newsprint volumes are 136 billion sheets, reducing from 150.5 billion sheets in 2013. That is a decrease of 9.63%. The total print volume of newspaper declined for the third consecutive year. The decline rates of newsprint are 2.86%, 7.67%, and 9.63% for the years of 2012, 2013, and 2014, respectively. The consumption of newsprint in 2014 is 3.05 million tons, a decrease of 9.76% compared to the previous year.

Industrial structure is changing; Packaging printing is growing rapidly.

Increasing concentration in the printing industry, especially the packaging printing, is observed. That is, the packaging printing is changing its structure. The

Pearl River Delta industrial belt centering on Guangdong remains its industry-leading position. Jiangsu Province located in the Yangtze River Delta industrial belt and Shandong Province located in the circum-Bohai-sea industrial belt become new growth points for the packaging printing. Overall, the Yangtze River Delta region is an important industrial base for packaging printing in China. The Pearl River Delta is focused on foreign trade printing, while the circum-Bohai-sea region is targeted on book printing. Over the past five years, packaging printing in Henan, Zhejiang, Anhui, Jiangxi, and Hebei area has higher growth rate. The development in Hebei Province is more prominent, probably due to the industrial transfer in Beijing area.

The dual impact of markets and policies is transforming the printing industry in China. Based on the data, the operating income of packaging printing is accounted for 67% of the entire printing industry in 2011 and increased to 76% in 2014. From 2011 to 2014, the numbers of large-scale packaging printing companies have reached 1,433 and the operating incomes increased at an annual growth rate of 28%. Packaging and decorative printing is continued to grow rapidly. The numbers of printing companies have reached 3,125 in 2014, an increase of 50 compared to the previous year. Its revenue is accounted for 54.2% of total revenue nationwide, a 4% increase compared to the previous year. In 2014, the revenue of packaging and decorative printing is increased by 12.7%, while that of flexible packaging is up by 24.9%. The revenue of large-scale packaging printing is 502.58 billion yuan, an increase of 124.45 billion yuan compared to the year of 2013.

2. The Pressures and Challenges for the Printing Industry in China

The traditional printing has faced several challenges such as taxing on environment protection, environmental print book for primary and secondary school, requirements for low carbon footprint and resource conservation, the usage of green materials to meet the needs of sustainable printing, food safety requirements for packaging industry, and the increased demands of personalized, short-run printing. Digital printing creates new opportunity for the packaging printing market. The improvements in the print accuracy, optical resolution, and print speed will enhance the quality and quantity of digital printing.

Influenced by the global economic environment, the printing industry is facing accelerating pressure for industrial transformation and upgrading. Global economic growth is likely to be weaker than earlier expected. With economic uncertainty, the demand for print has been declining. The printing industry is under pressure of increasing operating costs while the average printing profits have been declining. The business model is shifting from the speed expansion to focusing on the quality and content.

Since October 1, 2015, China began the VOCs sewage charges against five major industry sectors in 17 categories, which include furniture manufacturing, packaging, printing, petrochemicals, automobile manufacturing, electronic industry and others. Beijing even set up a stricter standard for the VOC emissions. According to the regulation in Beijing, the printing industry will need to pay the sewage charges for the emissions of VOCs. It is estimated that the VOCs sewage charges will exceed 200 million yuan every year, which counts 7% of printing revenues. This new policy has great impact on the printing industry. More and more print service providers start to use eco-friendly materials in the production processes. Manufacturers and suppliers are devoted to develop and produce eco-friendly equipment and materials.

Internet commerce gives rise to new kinds of business models and has great impact on the international industrial division. China's economic development has entered a new era with promoting structural transformation and industrial upgrading. Green production will become the new format for the packaging printing. New development trends in the packaging printing include expanding industrial chains, optimizing industrial structural, and increasing innovation capability.

3. Future Trends of the Printing Industry in China

Traditional printing has been in a general decline over the past few years. In order to face the challenge of intense competition in print markets, the printing industry in China has been pursuing sustainable development in the areas such as information and network technology, digital printing, printed electronic, security printing technology, the culture industry and art reproduction, green printing/energy conservation, and label/packaging printing.

New technologies such as digital printing and inline processing have been adopted in the packaging and printing industry, contributing to the quality improvement of print products. Paperboard packaging, flexible

packaging, label printing, and corrugated packaging have employed advanced technology and equipment. The level of the print quality is near the most developed countries over the same period. The manufacturing quality of packaging printing presses and equipment also meets the development/technological innovation needs of packaging and printing industry.

3.1 Information, Digital Technologies, and Web-to-Print

The integration of Internet and print has opened up opportunities for commercial printers, allowing the industry to optimize the allocation of resources and facilitate sustainable development.

The personalized/on-demand printing has grown rapidly. By the end of year of 2014, 8,792 color sheet-fed digital presses were in operation in China with an increase in the rate of 14%. There are 2,622 printing companies that have digital printing equipment. The number of companies has grown 5.4%. In terms of number of digital printing devices installation, the total amount is 5,469. Among those digital printing devices, 1,060 digital printing devices had been installed in the year of 2014, with the growth rate of 24% (as shown in Figure 3). The growth rate is correlated to the business expansion; however, this data also show the vitality of the digital printing industry. The installation of high-end, continuous feed color digital printers has also shown rapid growth over the past couple years. As shown in Figure 4, the total number of digital printer installation in 2014 is 95, with 23 printers were installed in 2013. The growth rate is 34%. Among those newly installed digital print devices, 6 high-end, continuous feed color digital printers were used to output personalized wallpaper. The applications of digital printing presses are unlimited. The installations of high-speed inkjet printers for the medicine labels and drug codes print are increasing. On the other hand, there are several companies provide on-demand printing services as the need of on-demand publishing has increased over the last two years.

With the integration of Internet and print, web-to-print platforms such as Print Home (http://www.print-home.com/), 98EP (http://www.98ep.com/), YINCAT (http://www.yincat.com/), and CPRINT24 (http://www.cprint24.com/) not only reduce operating costs, but also increase market efficiency. The key success factor for print e-commerce is the quality of print products.

Cross media integration is another trend in China. Jiangsu Phoenix Publishing & Media group, the largest publishing group in China, is engaged in publishing, printing and distributing of books, periodicals, newspapers, electronic and audiovisual products as well as printing material supplying and copyright trade. Its Cloud Computing Center has installed around 20,000 servers, providing printing and publishing services in all kinds of commercial areas. Several video-sharing service providers such as Baidu, QQ, Youku, LETV were stationed in its Cloud Computing Center.

Digital printing opens up new fields of application for packaging. First, digital printing can be used in the personalized packaging field; variable data printing is employed in the anti-counterfeiting packaging area. Second, point-of-sale displays are sales promotions that are placed where they can easily draw customer attention and trigger impulse buying. Digital packaging can

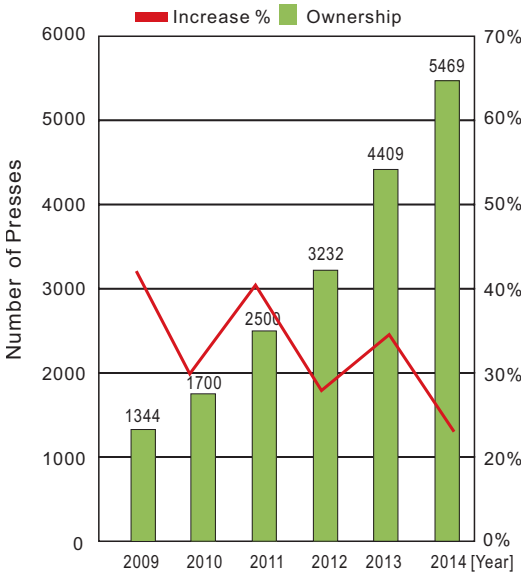

Figure 3: Ownership and increase % of color sheet-fed digital presses, 2004 - 2014

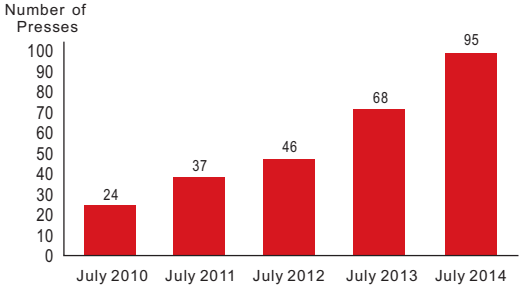

Figure 4: Ownership of continuous feed color digital printers, 2004 - 2014

be used for high quality, short-run packaging production at reasonable price. Third, digital printing workflows and color management proofing systems allow unified designs be printed at different sites with consistent color reproduction.

According to statistics, over 1,000 wide-format digital printers have been installed every year. On-demand digital printing technology has been adopted in areas of paper media, textile, and building materials. Around 50 robots were employed in the material handling, finishing and binding areas. There are 5 printing companies start up "intelligent printing plant." People from northern part of Shaanxi Province established remote monitoring & diagnostics platform and set up structure and solutions for intelligent printing plant.

Web-to-print is a convenient way to print. It is not a printing method but a printing solution. Web-to-print can break through time and space constraints and provide low cost, high efficiency services for customers. With digital technology and network technology, Web-to-print has been developed in China. Jiangsu Phoenix Xinhua Printing Co., Ltd signed a cooperation agreement with Beijing Founder Electronics Co., Ltd on July 10, 2013. They work together to speed up the construction of ifonhon cloud print service platform, which provides 24-hour print service to meet customers' need.

Internet and digital technology has huge impact on the traditional printing industry. However, it opens up opportunities for the printing industry. In order to face unprecedented challenges, Chinese printing industry will need to speed up technological progress and accelerate the restructuring and development. Internet + Print is creating a new business model. Learning the successful experience from foreign countries will help the printing industry to explore new service delivery models.

3.2 Printed Electronic and RFID Tags

Printed electronics is a set of printing methods used to create working electronic devices. Many of the advancements in the printed electronics industry were created to be cheaper, less processes, less energy consumption, more productivity, less material use, and more eco-friendly alternatives to more wasteful materials used in current manufacture of electronics. Printed electronic devices are thin, lightweight, and flexible. Applications for printed electronic include organic photovoltaic (PV), RFID tags, flexible batteries, organic sensors, and intelligent products.

A research report from the IDTechEx shows that the global printed electronic product reached $1.9 billion in 2009. The fastest-growing areas include solar batteries, OLEDs and electronic paper displays, followed by thin-film transistors, flexible OLEDs, sensors, and batteries. The total market for printed electronics will grow $57.2 billion in 2020, with 76% of the products will be printed, and 73% of the products will be produced on flexible substrates.

Applications for RFID continue to expand. Increasing market demand will result in deployment of RFID technology in large-scale applications. Figure 5 shows RFID applications and market shares in China.

According to the China RFID Industry Alliance and the Ministry of Electronics, the market size of China's RFID industry reached 31.84 billion yuan in 2013, an increase of 34.6% compared to the year of 2012. RFID development in China will enter a virtuous circle and into the golden period of the development. The major applications of RFID technology include electronic toll collection (ETC) systems and intelligent transportation systems. As shown in Figure 6, the market size of China's RFID industry is expected to reach 65.15 billion yuan in 2016.
In the traditional RFID paper tag production process, a PET plastic inlay is inserted in between paper layers. From the security standpoint, there are concerns about the security flaw of RFID tags. In addition, antennas printed with traditional electronic inks usually resulted in high production cost and poor process consistency. Mr. Jiao Lin from the SHENZHEN JG Technology Industries Co., Ltd invented a new generation of inlay-free RFID paper tag. New generation of RFID paper tags can reduce production costs and increase productivity by placing aluminum foil antenna and embedding chip on the base paper without PET inlay. With no plastic inlay, the smoothness of RFID paper tag is improved; therefore, other finishing operations such embossing and foil stamping can be applied to the RFID paper tags. The thickness of RFID paper tag is in the range of 0.08 mm to 0.4 mm.

As shown in Figure 7, the applications of RFID paper include RFID letter paper, RFID invoices, diploma with chip, real estate certificates, passes, passports, tickets with chips, RFID labels, hang tags, cards, RFID boxes, food bags, and sealing pads for pharmaceutical packaging. According to the requirements of RFID products, a variety of RFID chips and antennas are available for different thicknesses of RFID paper. RFID paper tags can be printed with traditional printing processes such as offset, gravure and flexographic printing.

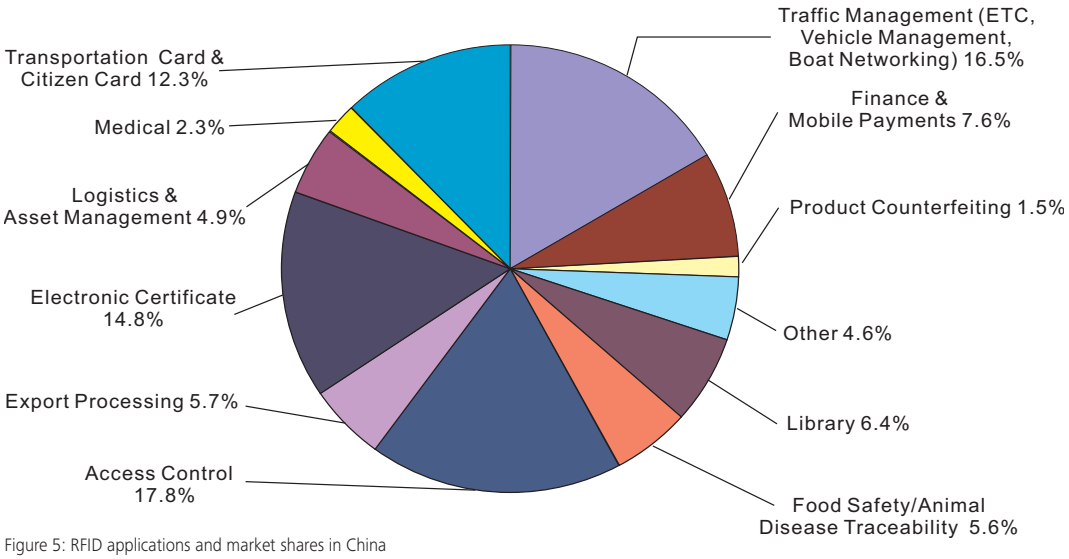

Figure 5: RFID applications and market shares in China

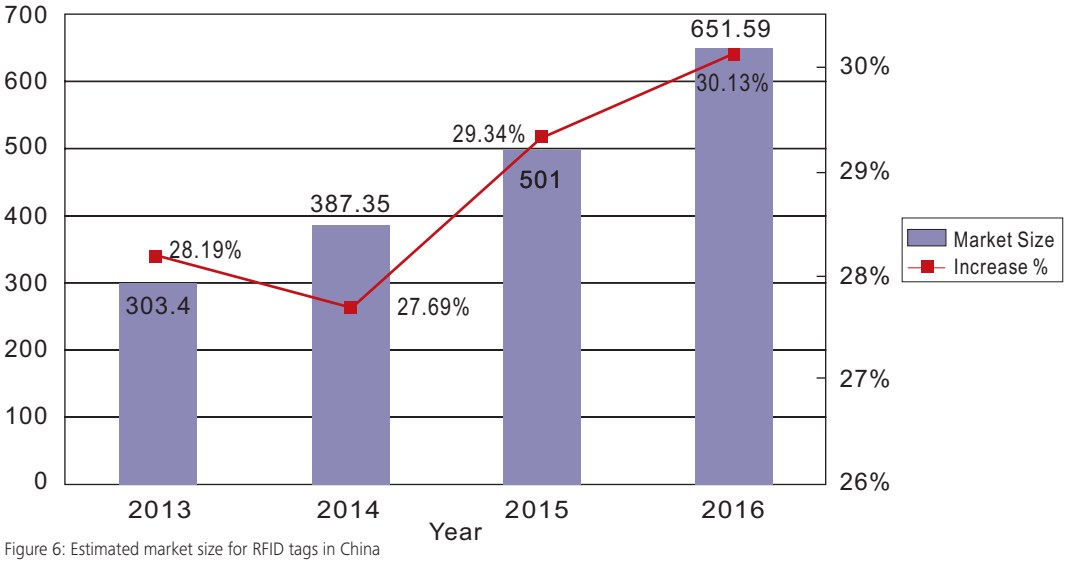

Figure 6: Estimated market size for RFID tags in China

3.3 Green Printing and Energy Conservation

The idea of practicing green printing is to conserve energy, improve environment, benefit people's livelihood, and adjust industrial structure. Since 2012, Beijing Institute of Graphic Communication was commissioned by the State Administration of Press, Publication, Radio, Film and Television of the People's Republic of China to conduct an assessment on the results of practicing green printing. This report shows that China has made remarkable progress in practicing green printing over the past five years. It has laid a good foundation for the printing industry to accelerate the construction of ecological civilization. According to statistics, 925 companies had gotten green printing certifications. They only account for 1% of the printing industry in China, but their output values have accounted for about 15% of total production. There are 88 printing material suppliers who offer environmentally friendly paper, green printing plates, eco inks, and other eight categories of green printing

raw materials. 20 green printing inspection agencies were certified by the State Accreditation Committee (CNAS) and offered inspection services for the industry. Over 10,000 Computer-to-Plate systems had been installed nationwide. CTP plate sales have accounted for 70% of total offset printing plate sales. Practicing green printing has continuously reduced energy consumption and wastes. National printing industry clean production evaluation index system is established. Nearly 200 printing companies have passed the cleaner production audit across the country. Therefore, nearly 2,000,00 employees have benefited from the improved work environment.

Green packaging and printing standards, cleaner production evaluation index system, and green printing inspection were established for the green packaging printing. Through the implementation of green printing and use of eco-friendly materials, technology and equipment, the printing process can continue to reduce the energy consumption and the "three wastes" emissions. According to a sample survey conducted on the nationwide 40 large-scale flexible packaging printing companies (account for about 5% of revenue of flexible packaging printing), 10% of companies use eco-friendly ink, 16% of companies use a solvent-free composite technology, and 20% of companies have or are installing VOCs recycling devices. These environmental initiatives reduce the total emissions by about 33%.

In 2015, 1.2 billion textbooks for primary and secondary schools nationwide were printed using green printing. The infant's books in Beijing, Shanghai and other regions also adopted green printing. The sample survey estimated that the amount of green ink has accounted for 25% of the total amount of ink usage, an increase of 5% over last year's total. In the offset printing area, there are 30% of companies have installed the dust collection device. Nearly 50% of employees have benefited from the improved work environment.

3.4 Label Printing and Packaging Printing

According to the Pira, by 2016, the global paperboard product is expected to reach $250 billion; rigid plastic is expanding to over $200 billion, while the flexible packaging market will increase to above $163 billion; the consumption of metal packaging is anticipated to reach $45 billion. Digital print offers many advantages to packaging companies. The global packaging and digital label printing market is growing rapidly and is expected to reach $122 billion by 2016. The Compound Annual Growth Rate (CAGR) is expected to reach 20.6%. According to the Pira, the U.S. was the largest consumer for packaging and digital label printing, followed by the countries in Asia. The global packaging and digital label printing is also growing rapidly in the developing countries. The CAGR for packaging and digital label printing in Turkey, China, India, and Brazil is expected to over 30%.

In an article titled "2014 flexographic printing in China," there are 1,581 flexographic printing presses were installed in China, with the growth rate of 10.9%. 1200 out of 1,581 flexographic printing presses are made in China. This shows China-made Flexo printing press has

RFID Invoice RFID Cards RFID Cigarette Box

Figure 7: Inlay-free RFID products

become the leading machine used in the domestic Flexo printing market.

Over the past two years, the demand for satellite type flexographic printing presses is increasing as high-end flexographic printing technology and print quality have been improved. According to a survey from the China Printing Technology Association (CPTA) Flexographic Printing Branch, 46 satellite flexographic printing presses were installed nationwide in 2014. Among those presses, 42 of 46 are made in China (accounted for 91%). There are 6 presses are exported to other countries. Several made-in-China satellite flexographic printing presses are distributed to England, Ukraine, Bulgaria, Paraguay, Vietnam, etc. Over 5,000 stack type flexographic printing presses are in operation; corrugated printer slotters reach 10,000 units. Four-color flexographic printing presses are the most popular ones. The numbers of all different types of flexographic presses are increasing, that is, the flexo printing market shares are expanding in China. According to customs based data, 53 of flexographic printing presses (including stack type, satellite type, and unit type) were imported in 2014, worth a total of $79 million with $1,490,000 per press. There are 1,141 flexo presses were exported, worth a total of $30 million with $27,000 per press. It shows that the export markets of flexo presses have great potential.

High definition flexo plate and flat top dots technology expands the color gamut and improves the ink coverage and solid ink density, resulting in higher resolution and better image reproduction.

Improved technology laid a great foundation for promoting the usage of green flexographic technology. The

Substrate Types	Production (10,000 tons)		% Increase	Consumption (10,000 tons)		% Increase
	2013	2014		2013	2014	
Newsprint	360	325	-10	362	321	-11.33
Uncoated paper	1,720	1,715	0	1,627	1,629	0.12
Coated paper	770	775	1	623	625	0.32
Packaging paper	635	650	2	650	665	2.31
Paperboard	1,360	1,395	3	1,310	1,301	-0.69
Cardboard	2,040	2,180	7	2,106	2,240	6.36
Corrugated board	2,015	2,155	7	2,013	2,152	6.91
Special paper and paperboard	230	250	9	188	205	9.04
Household paper	795	830	4	734	759	3.41
Miscellaneous	185	195	5	169	174	2.96
Total	10,110	10,470	4	9,782	10,071	2.95

Table1: Nationwide paper and paperboard production and consumption in 2014

application of advanced technologies and structures can improve the quality level of traditional printing process. Waterless offset printing has advantages of eco-friendly, better image reproduction, and expanded color gamut.

With the development of commodity economy, the label industry has also gained a rapid growth. Hybrid printing combining digital printing with exchangeable flexo/screen/offset/gravure printing technology can be used for high quality label printing. Based on the statistics from the Printing and Printing Equipment Industries Association of China, the label printing increased with 13-20% growth rate from 2010 to 2013. In 2014, the label printing showed a slower growth trend but still with a steady growth rate of 10%. Its growth rate is still higher than other printing industry. According to statistics, express delivery growths rapidly with an average growth rate of 50% since 2010. By the year of 2104, express delivery cases had reached $13 billion. The output vale of express delivery labels had reached $1.17 billion ($0.09 per case) in 2014. Manufacturers of China made label printing equipment work with online inspection system supplier to release new machines, which occupied the domestic market and exported to other countries.

A survey conducted by the China Paper Association in 2014 shows that there are around 3,000 paper and paperboard manufacturers in China. The domestic paper and paperboard production is 104.7 million tons, with a growth rate of 3.56%. Paper consumption is100.71 million tons, with an increase rate of 2.95%. Average annual consumption per person is 74 kg (population: 1,368,000,000). From 2005 to 2014, the average annual growth rate of domestic paper and paperboard production is 7.2%; the average annual growth rate of paper and paperboard consumption is 6.06%. Statistics on nationwide paper and paperboard production and consumption from 2005 to 2014 is shown in Figure 8. Table 1 lists nationwide paper and paperboard production and consumption in 2014.

According to the statistics, the printing ink output from the top 20 ink manufacturers is around 377,000 tons, producing 50% of printing inks in China. The printing ink industry in China has three main industrial belts - the Pearl River Delta industrial belt centering on Guangdong, the Yangtze River Delta industrial belt surrounding Shanghai and Zhejiang, and the circum-Bohai-sea industrial belt around Beijing, Tianjin and Liaoning. Domestic ink producers have a major position within the ink segments. China's printing ink manufacturers are committed to develop non-toxic, zero pollution, and environmentally friendly printing ink. Eco-friendly inks have been showing steady growth in China as its ink manufacturing techniques and management has been improved.

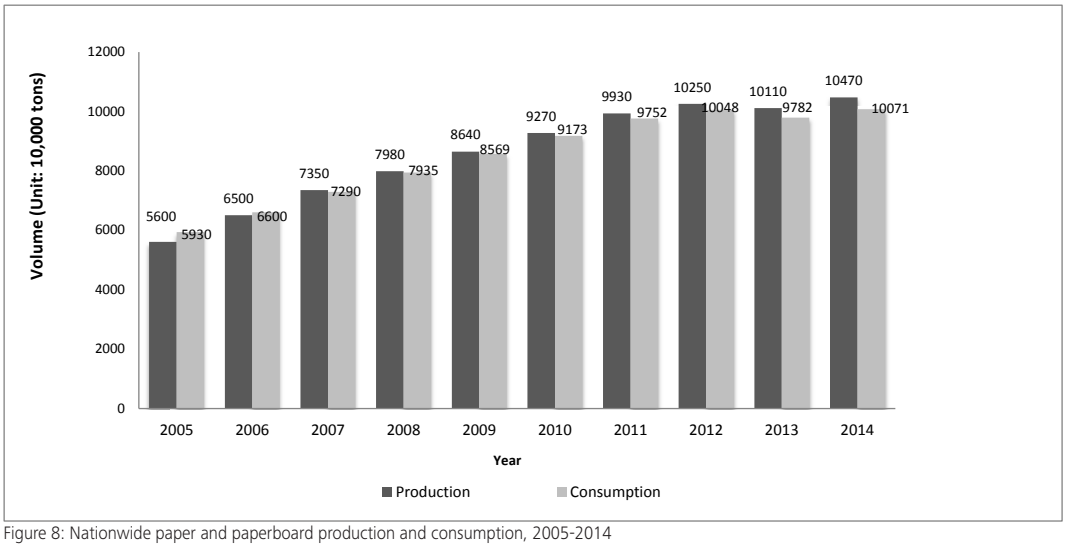

Figure 8: Nationwide paper and paperboard production and consumption, 2005-2014

4. Research Development by the Printing Industry of China

The Overall Objective

1. Keeping up the growth rate of the printing industry with national economic development simultaneously. Laying a solid foundation and becoming the largest print service provider in the world.
2. Following industry trends of digitizing, informatization, networking, and intelligent. Promoting integration of advanced science and technology in the printing industry and transforming into a fully digital era.
3. Extending industrial chain; integrating creativity and design elements; developing Internet + public service platform; achieving the transition to the modern service industry.
4. Establishing green printing system and green printing inspection system. Promoting cleaner production. Practicing green printing in the publishing, commercial printing, and packaging/decoration printing field by the end of Chinese "Thirteen Five" period.

Main Tasks

1. Promoting the optimization and upgrading of the industrial structure. Promoting transformation of diversified publishing, digitizing, and networking. Implementing green printing technology and using eco-friendly packaging materials.
2. Accelerating the development of national printing demonstration enterprises. Increasing the guiding role of the industry and extending its exemplary impact.
3. Focusing on the development of digital printing and digital printing engineering. Enhancing information management in the printing industry by using network and big data technology.
4. Implementing the construction of ecological civilization. Creating a cleaner production demonstration base. Achieving the integration of green materials and environmental protection equipment.
5. Promoting technology and innovation-driven development in the industry. Closely attention to the international Industry 4.0 development strategy.
6. Promoting cross-area integration and developing new printing industry. Using key generic technologies and major projects as the starting point to achieve communication and integration between the industry and the cross-area exchange between upstream and downstream industries.
7. Strengthening protection of intellectual property and enhancing the core competitiveness. Creating a corporate culture of innovation and technological transformation to encourage enterprises to take the road of development of independent intellectual property rights.

Safeguard Measures

1. Promoting industrial transformation and structural adjustment simultaneously; encourage enterprises to provide diversified products by achieving full integration of print and modern services; and to establish a service-oriented, high-performance industrial structure.
2. Expanding the scope of business models and increasing the intensity of new technologies–encouraging competitive enterprises to play a leading role in promoting the integration of quality resources through policies and by providing financial support to advance the implementation of new business ventures or technologies.
3. Actively promoting interactive development between on-demand publishing on-demand printing. Reducing publishing inventory and lower industrial chain costs. Striving to achieve the POD production line and material localization.
4. Packaging and printing focus on "creative design" and "green." Vigorously promoting the development and application of environmentally friendly raw materials and packaging and printing equipment. Focusing on flexographic printing, development of solvent-free composite technology, and local production.
5. Promoting information technology, big data, and the depth of integration of the printing industry and the Internet. Developing "Internet +" action plans to promote the Internet, cloud computing, big data, networking and other strategic and emerging markets combined printing
6. Expanding green printing achievements. Supporting innovation and application in green printing technologies, processes, materials and equipment. Creating a group of cleaner production demonstration projects.
7. Realizing quality, efficiency, and upgrade through technological innovation. Supporting and encourag-

ing the development of industrial technology innovation alliance. Highly supporting innovation projects of digitization, highly automated, intelligent, green printing.

8. Accelerating the pace of the printing industry and expanding international exchanges and cooperation. Constructing exports of printing industry with complete social and industrial service system. Establishment of an international printing market information center. Expanding printing equipment and printing equipment exports.
9. Promoting innovative training mechanism and optimizing professional personnel structure. Supporting advance of vocational education and innovation of institutional training system. Continue to improve and standardize vocational accreditation mechanism and establish a standardized skills system.
10. Strengthening construction of industry credit system and credit risk management knowledge training for enterprises. Helping enterprises to establish credit risk prevention mechanism.
11. Promoting printing standardization. Establishing a mechanism with flexibility and diverse standards to promote the industrial application of standardized technological innovations.
12. Strengthening self-construction for the industry associations to play a role on the coordination and management. The main tasks include assisting government departments to strengthen inspection and supervision in the industry, promoting the introduction of relevant policies, conducting survey to gather industrial statistics and data, developing industry planning, information consulting, market analysis, professional training, research, evaluation assessment, building a platform for international exchanges, etc.

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