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Study on ICT Industrial Integration in New Industrial Revolution: A Survey of Chinese Mainland and Taiwan

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Abstract

In today's world, two changes are going on: reconstruction of global manufacturing value chain and remodeling of trade and investment patterns. In the background, developing cross-strait economic cooperation in depth by promoting industrial integration will be a win-win choice. It is better for improvement of welfare to the people on both sides of Taiwan straits. Furthermore, the electronic information industry is a field which is most essential and necessary to be integrated for Mainland and Taiwan. With the integration of electronic information industry, both sides will face not only more opportunities with the new round of global industrial revolution coming, Asia-Pacific regional economic integration and new strategies for the mainland China in further opening to the outside world, but also more challenges such as uncertainties in core technical breakthroughs, multi-track operation in Asia-Pacific regional economic integration, and the changes of Taiwan political situation. This paper describes the foundation for cross-strait ICT industry integration and the challenges in its new newly-developing industries by the qualitative analysis from technology, economy, politics and mainland China. Finally it is intended to bring about the paths needed for the integration. The results suggest both mainland and Taiwan should establish common industrial standards based on capital integration and further specialization and cooperation in the industrial chain. Besides that, both sides should jointly develop and break through major core technologies gradually to realize the integrated development in an all-around way.

Keywords: ICT industry, integration opportunity, integration path

1. Introduction

In the post financial crisis period, the major European and American countries attached importance to the development of entity economy once again. They carried out new strategies in industrial development, and expected to forge new competitive edges in their national manufacturing and recover their economy. The main purpose for whether US reindustrialization, Germany Industry 4.0, New Industrial France, or UK Industry 2050 is to drive manufacturing toward intelligent manufacturing or Collaborative Manufacturing (Glowacki-Dudka, M., 2013). Substantially, they deeply integrated new information technology, network technique and manufacturing. In this fertile economic ground, a new round of global industrial revolution has revealed its importance for the first time (Gao Binbin et al., 2013).

The new industrial revolution will mark the profound changes in global manufacturing patterns and structure, so that the existing position and interest patterns will be reshuffled in global manufacturing network for different countries and regions. This will exert a far-reaching influence on the two sides' industrial development, especially information and communication technology (ICT) which will be the first to be affected. Currently, ICT in Mainland and Taiwan has been blended into global manufacturing system to a great extent, but it is still standing in the low end in industrial chain specialization. In the wave of the new industrial revolution, how does the two sides' ICT industry promote its status in international specialization? This is an unsolved issue that deserves our attention. On the basis of mutual trust and benefit, both sides should bring their own advantages into full play in in-depth cooperation for a complementary effect. By this way, Taiwan and Mainland can promote their position in the international specialization in a new round of changes. This will be a most beneficial and advisable way to both sides, whereas the key and core for the in-depth cooperation are to successful industrial integration.

This paper describes the foundation for cross-strait ICT industry integration and the challenges in its new

newly-developing industries by the qualitative analysis from technology, economy, politics and Chinese mainland. Finally, it is intended to propose the paths needed for the integration.

2. Industrial Integration for Both Sides of Taiwan Straits

In recent years, more and more scholars paid close attention to promoting Chinese Mainland's position in the international industrial specialization with its increasing participation in specialization. They carried out relevant studies based on intra-product specialization or theories about global production network. Slywotzky and David (1997, 1999) consider profits business can generate profits for businesses. Meanwhile, it discusses the value of professional and strategic from inside to outside of the industry value chain. Gereffi (1994, 1999) studied the combination of industrial organization and the value chain analysis, and global commodity chain analysis framework is presented; Humphrey and Schmitz (2000, 2002), and Gereffi et al. (2005) used global value chain to build (Global Value Chain, GVC) theory. International division from the inter-industry, intra-industry has been up to intra-product specialization. The high-tech industry development is more applicable on intra-product specialization and vertical specialization（Lu Feng, 2007; Cao Qiujing, 2014）.Sun Shaoqin and Qiu Bin (2011) applied the global production network factor to positivism models. They studied the FDI technical spillover effect on Mainland's domestic manufacturing enterprises by forward, backward and horizontal linkages using 2001-2007 manufacturing panel data. Their research results show that in global manufacturing network, FDI has produced technology spillover effect on the Chinese domestic manufacturing enterprises as a whole in forward, backward and horizontal linkages. It upgraded total factor productivity, technical efficiency and technical advance to great degrees. In the network, FDI improved the total factor productivity to high technological industry and low capital-labor ration industry by forward spillover. So did it to the low export-oriented industry and the high capital-labor ration industry by backward spillover, and to all industries by the horizontal spillover. Chinese Mainland is changing its role from the former "processing workshop" into a "manufacturing base" even a "world factory" in global manufacturing network. In a latest study, referring to global value chain (GVC) and revealed comparative advantage (RCA) indexes, CEN Li-jun (2015) compared and explored specialization-based trade status and real trade benefit for Mainland's export trade in global manufacturing network based on TiVA data. Their conclusions show Mainland has been integrated into global manufacturing network to a greater extent, but still sitting in a lower position in the global value chain in a V-shaped development trend. Its labor-intensive industry, though standing in a higher position and developing towards the upstream, demonstrates extremely strong competitiveness in the world market, but its momentum is declining remarkably. Its capital-intensive, skill-intensive and knowledge-intensive industries are involved in global manufacturing network to a greater degree. However, it is developing towards the downstream, with less contribution to the increment of domestic values and less gains in trade benefit.

Information industry is crucial to cross-strait industry cooperation fields and has been of common concern in theory circle areas for a long time. In 2002, mainland China and Taiwan accessioned to the WTO, it set off a wave of research of cross-strait IT industrial cooperation, such as Ma Fengbiao, (2002), Cao Xiaoheng (2002), Zhang Yuanpeng (2002) and Jin Wenzhi (2010). Considering such indexes as trade balance and its contribution degree, revealed comparative advantage (RCA) and triangular trade, YU Chun-jiao and XU Ling (2010b) investigated Chinese Mainland's specialization status in the East Asia electron manufacturing industry based on trade data of ICT sub-sectors. Their researches show that as a manufacturing center in East Asia manufacturing network, Chinese Mainland plays the processing and assembling roles for the most part in the electron manufacturing network, still sitting at a low-end level in the value chain specialization. Taking an example of iPhone profit structure, LIN Ling and YU Juanjuan（2012）conducted a modeling analysis on global manufacturing network as well as Mainland's distribution status. The analysis shows that in global manufacturing network, the product manufacturing process is split into the states or regions with different factor endowments for internationalized manufacturing. The relative scarcity for specialization factors has determined the distribution of relative benefits. Due to limitation of factor quality, Chinese Mainland mainly contributed to the processing and assembling in low value added manufacturing. As a result, it shared lower profits.

In the background of economic globalization, the vertical specialization and subdivision form in production factors and industrial value chain led by transnational corporations worldwide for the international electronic information industry. Thereby, a global production network comes into being for electronic information products. Chinese mainland and Taiwan can't do without the production network nationwide. For iPhone4, its production network and industrial chain are shown in Table 1.

Table 1. IPhone4 main components and its suppliers

Components	Supplier	Country or region	Cost($)
LCD monitors	LG Display	South Korea	28.50
NAND flash memory device	Samsung-Toshiba	South Korea/ Japan	27.00
baseband	Infineon Technologies	Germany	14.05
DRAM	Samsung	South Korea	13.80
A4 processor	Samsung	South Korea	10.75
Touch Panel	TPK / wintek	Taiwan	10.00
LENS	Largan Precision Co. / GeniuS Electronic Optical Co., Ltd.	Taiwan	9.75
Wi-Fi、Bluetooth、GPS	Broadcom Corporation	United States	9.55
Assembling	Foxconn	Mainland China	6.54
Gyroscope、Accelerometer	STMicroelectronics	Switzerland	3.25
RF memory chip	Intel Corp.	United States	2.70
Power Management IC	Dialog	Germany	2.03
Touch Screen	Texas Instruments Inc.	United States	1.23
MUSICAM Encoder	Cirrus Logic Inc.	United States	1.15
E-Compass	AKM	Japan	0.70

Source from: Zeng Hang: IPhone hard? Bored? Taiwan, Taiwan: Human Thesaurus Publishing Group, 2012.

Obviously, such products as iPhone series have constituted a highly developed production network worldwide, and the product value chain is shared by more enterprises in many countries and regions.

The value distribution in global industrial chain is shown in Figure 1. It is seen that the Apple products in both Mainland and Taiwan are in the low end with a thin profit in global production network. Thus, two sides face the common tasks-participating in global specialization and upgrading industrial status in global production network at a high level.

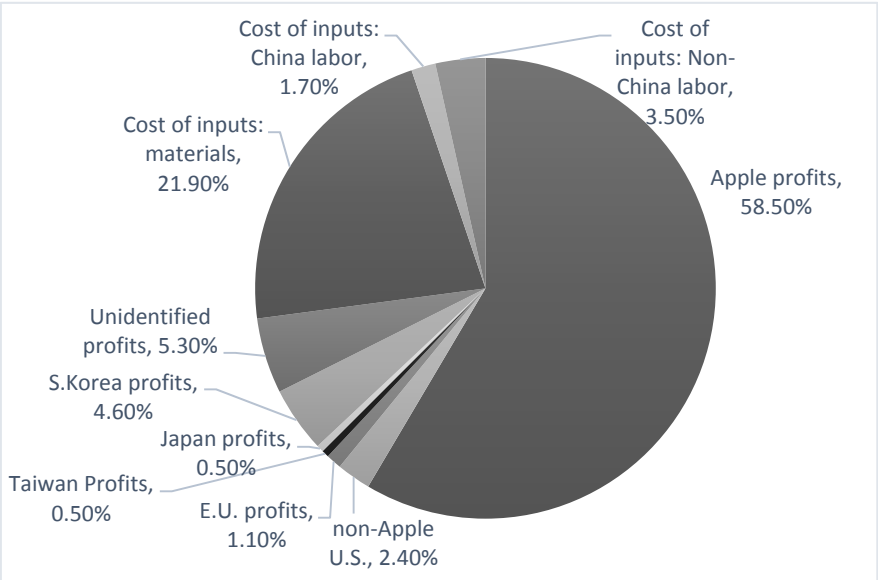

Figure 1. Distribution of value for iPhone, 2010

Source: Kraemer K, Linden G, Dedrick J. Capturing value in Global Networks: Apple's iPad and iPhone. University of California, Irvine, University of California, Berkeley, y Syracuse University, NY. http://pcic. merage. uci. edu/papers/2011/value_iPad_iPhone. pdf. Consultado el, 2011, 15.

For IC industry, its production can be roughly divided into three phases: design, manufacturing and package & testing. The IC design is sitting at the upstream of the industrial chain as a knowledge-intensive industry, whereas the manufacturing is a capital- and skill-intensive one; the package and testing belong to a

labor-concentrated industry. In recent years, the IC enterprises in the middle- and down-stream have shifted gradually from overseas to the Mainland China, and towards IC design. At the same time, the firms in the Mainland China are actively shifting to capital- and skill-intensive industries besides labor-intensive ones. Apple INC. reported manufacturers of Mainland China increased by 5 in the list of supply chain of 2014; if two sides' IC industries can be integrated more appropriately with the rise of Red China supply chain, both will achieve bigger status and profits in the global specialization. Next, this paper will conduct analyses at different levels on the foundation for cross-strait ICT industry integration.

Following this paper analysis the different levels of the basis for cross-strait ICT integration, and try to suggest possible paths.

3. Foundation for Cross-Strait ICT Integration

With continuously expanding investment scale in Mainland, more and more Taiwan's electronic enterprises joined Mainland's industrial layout, establishing a close contact between two sides in electron information industry and forming two sides' electronic product industrial chain. This booms an increasing trade of electronic products in scale, and lays sound market foundation for integrated development of two sides' electronic information industries in the future.

The electronic information manufacturing is always a key field for Taiwan businessmen to invest to Mainland. They play a bellwether role in the cross-strait economic and trade exchanges and cooperation. On the whole, Taiwan businessmen's total approved investment amount to Mainland came to 49.023 billion dollars during 1991-2014, accounting for 34.05% of total investment in 143.957 billion dollars to Mainland in the corresponding period. Among them, the approved cumulative investment amount was 27.424 billion dollars for electronic components industry, 18.84% in total amount to Mainland; 19.701 billion dollars for computer, electronic products and optical product manufacturing industries, 13.69% in total amount to Mainland; 2.192 billion dollars for information and communications, 1.52% in total amount to Mainland.

There are three phases for Taiwan businessmen's investment for electronic information manufacturing to Mainland since 1990 by phased investigation:

Phase I—Start-up (1991-1999): Taiwan businessmen's investment to Mainland was shifted from the former labor-intensive industries such as food and textile to ferrous metals, mechanical equipment and chemical industries. The investment for electronic information increased rapidly as a whole, but a less scale in total investment.

Phase II—Large-scale investment (2000-2010): After 2000, some large-scale investment projects such IC and IT entered into Mainland, forming the third investment fever as representatives of IC and IT. The new round of investment projects were mainly involved in such capital-intensive and skill-intensive industries as computer, semiconductors and precision machinery. The electronic information industry becomes more and more important in Taiwan businessmen's investment to Mainland.

Phase III—Adjustment and optimization (2011 up to now): With signing of ECFA and opening-up of service industry in the Mainland since 2010, the service industry has become a major one increasingly invested by Taiwan businessmen, while the electronic information industry declined to some extent in the Taiwan businessmen's investment proportion to Mainland, indicating Taiwan businessmen were adjusting and optimizing their investment layout in Mainland.

The cross-strait trade has been at full speed in the past 20 years after driven by Taiwan businessmen's investment to Mainland. Currently, Mainland has become a leading trade partner and product export place for Taiwan. At the same time, Taiwan is the seventh trade partner and the fifth export source for Mainland. Furthermore, from cross-strait electronic product trading, the trade volume of electronic products came to 77.961 billion dollars from 19.857 billion dollars from 2003 to 2014, up 13.2% on annual average, demonstrating their leading position in cross-strait trade. The electronic products will still hold dominant in the future in the cross-strait trade.

Since consultations by the two-meeting mechanism, both sides have held 10 high-level talks, established 21 agreements and reached 2 consensuses, involving economy and trade, finance, transportation, society, hygiene and reciprocal judicial assistance. Especially, since ECFA was signed in 2010 in cross-strait meetings, the cross-strait economy and industries have ushered in a new period of institutionalized exchange and cooperation. This laid foundation for future cross-strait industrial integration in institutional perspective.

Since 2005, both Information Industry and Technical Standard Forum of Mainland and Taiwan have being held in an alternative year jointly by China Electronics Standardization Association, China Communications Standards Association, and SINOCON Industrial Standards Foundation. Up to now 288 consensuses are reached.

This forum has become an important platform and a brand for cooperation of information industry and technical standards for both sides. Thus, the substantial progress has been made in developing common standards of cross-strait information industry.

To sum up, the sound foundation has been laid for the integration of cross-strait electronic information industry through analyses on cooperation in electronic information industry from market, system and common technical standards.

4. Challenges to Cross-Strait ICT Industrial Integration

The electronic information industry is a most dynamic, driving and extensively permeable area in global innovation, and is also the one where two sides have the broadest and deepest cooperation in economy currently. It is far ahead of other industries in Taiwan businessmen's investment amount and trade volume to Mainland. Meanwhile, with severely competitive market environment in the world as well as further decline of two sides' factor endowment, it is difficult to sustain the cooperation mode of "European and American technology and market + Taiwan capital + Mainland labor force" formed before in the cross-strait electronic information industries. It can be asserted that the electronic information industry is an area which two sides are most conditional and necessary to integrate.

Two sides are facing opportunities and challenges in electronic information industrial integration. The opportunities mainly include the first sign of new overall industrial revolution, Asia-Pacific regional economic integration and new strategy for Mainland's opening to the outside world. The challenges refer to uncertainties in core technology breakthrough, multi-tacking operation in Asia-Pacific regional economic integration and changes of Taiwan political situation.

4.1 Technical Level: Uncertainties in Core Technical Breakthroughs

The electronic information industry is a typical technology-intensive one. It development depends on highly new techniques, especially major constant breakthroughs in core technologies. So to speak, ones that have obvious advantages in technology will have capacity to integrate relevant resources and market. At present, the electronic information industry in Mainland is still lack of key core technologies and equipment compared with the ones at advanced world levels. Its industrial development is still restrained at technical levels to a great extent. Taiwan's electronic information industry had stronger technical edges in the integrated circuit area for a time depending on the Industrial Technology Research Institute. But its advantages were weakened in this field in recent years, especially facing forceful competitiveness from Korean firms such as Samsung.

The cross-strait electronic information industries are relative lack of major core technologies, while these core technologies need more investment, long R&D cycle and high market risk. All these imply bigger uncertainties for two sides' major breakthroughs made in technical area in the future, as well as for the integrated development.

4.2 Economic Level: Uncertainty in Multi-Track Operation in Asia-Pacific Regional Economic Integration

In recent years, all kinds of multilateral, sub-regional and cross-regional cooperation are booming in Asia-Pacific region. The "10+1" and "10+3" cooperation of ASEAN with China, Japan and Korea, the regional comprehensive economic partnership (RCEP) driven by ASEAN, trans-Pacific partnership agreement (TPP) initiated by US, and free trade zone of the Asia-Pacific (FTAAP) driven by China, as well as China-South Korea free trade zone completed in negotiation, and China, Japan and South Korea free trade zone in underway negotiation, all demonstrate a new round of regional economic integration process is being accelerated in Asia-Pacific region.

The Asia-Pacific regional economic integration is just like a double-edged sword for cross-strait ICT industry integration. It not only providing external environment and new space for the integrated development of cross-strait ICT industry, but also means a potential uncertainty at the same time, which will adds risks and variation to the industrial integration.

Currently, a development trend of multi-track competition occurs like trans-Pacific partnership agreement (TPP) negotiation, regional comprehensive economic partnership (RCEP) negotiation and ASEAN-China-Japan-Korea (10+3) negotiation in Asia-Pacific regional economic integration. Mainland initiates RCEP negotiation, advocating to integrate TPP and RCEP by more inclusive free trade agreement of the Asia-Pacific (FTAAP), that is, taking the integration of TPP and RCEP as a way to FTAAP. Taiwan actively seeks and joins TPP and RCEP negotiations. Two sides signed ECFA successfully, which lays the foundation of institution for cross-strait cooperation in Asia-Pacific regional economic integration. It is a general trend for two sides jointly to be blended into Asia-Pacific regional economic integration. By this, the cross-strait industrial integration is necessary and

possible, and it can provide space for integrated development of cross-strait electronic information industry. However, as the follow-up topics for discussion were interrupted, it became more difficulty objectively for both sides jointly to deal with regional economic integration. So far, both sides have not reached a consensus or tacit understanding on how to be integrated into regional economy jointly. As the TPP negotiation initiated by US is at the final stage, the RCEP negotiation led by ASEAN is expected to be completed in this year. If Mainland and Taiwan can't reach a consensus on blending into regional economic integration in a short term, the negative effect will be exerted on cross-strait economic cooperation as well as the integration of cross-strait industries including electronic information industry in the future.

4.3 Political Level: Uncertainty in Changes of Taiwan Political Situation

Since the Kuomintang (KMT) suffered a crushing defeat in Taiwan Nine-in-One Election on November 29, 2014, the rotation of ruling parties may recur in 2016 Taiwan leadership election. The Democratic Progressive Party (SPDP) has a big difference from Kuo Min Tang (KMT) in their cross-strait policies. So ultimately, it adheres to its party programme on the Independence of Taiwan, and denies the 1992 Consensus on that "mainland and Taiwan belong to one China". Although Tsai Ing-wen, the candidate of 2016 Taiwan leadership vote nominated by SPDP, established the "maintaining cross-strait status quo" as a principle to deal with the relations across the Taiwan Straits, but she didn't make an explicit clarification all the time on what "cross-strait status quo" is. So, only to say this is nothing but an election strategy that she tried to make the issue fuzzy deliberately.

4.4 New Strategy for Mainland Opening to the Outside World

Since the 18th Communist Party Congress, China has actively been planning the new strategy of further opening to the outside world, so as to upgrade the open door to the outside world in an all-around way and drive the sustainable development of economy and society. The first strategy is to build up a free trade trial area (hereinafter referred to as "free trade zone"). The Central Government approved to establish the Shanghai Free Trade Zone in 2013, and set up Guangdong, Tianjin and Fujian free trade zones successively. As a result, a new pattern of free trade zones come into being from south to north in Chinese Mainland. The second strategy is to propose and carry out the Belt and Road Strategy. The strategic conceptions of "Silk Road economic belt" and the "21st Century Maritime Silk Road" were put forth in 2013 (hereinafter referred to as "one belt and one road"). These conceptions received extensive attention of international community and positive responses from some countries. In order to support implementation of the "one belt and one road" strategy, China initiated the Asian Infrastructure Investment Bank (AIIB） and the Silk Road Fund. Currently, the AIIB recruits 57 original members including UK, France, Germany, Korea and Australia. It will be established officially by the end of 2015 after the effective procedures of the AIIB chapter are completed. The Silk Road fund Co., Ltd. had been registered by the end of 2014, and it will provide investment and financing supports for the projects related to infrastructure construction, resource development, and industrial cooperation for the countries along the line of the One Belt and One Road.

According to above-said points of view, not only are new opportunities and momentum available for the development of Mainland economy, but also new conditions are offered to the further cooperation of cross-strait economy. Thus, the two sides' electronic information industry can be integrated in a more open marketing environment.

5. Exploration of Integration Path for Cross-Strait Electronic Information Industry

In 2011, total industrial output value for Mainland's electronic information manufacturing came to 7704.292 billion dollars, of which the sale value for four industries—electronic computer, electronic components, electronic devices and communication equipment were 2187.375, 1398.539, 1232.756 and 1205.263 billion dollars respectively (Fig.2), accounting for 28.4%, 18.2%, 16.0% and 15.6% successively in the whole industrial sale value (Fig.3). The sale value for the first four industries made up 78.2% in total proportion, which was in an obvious dominant status.

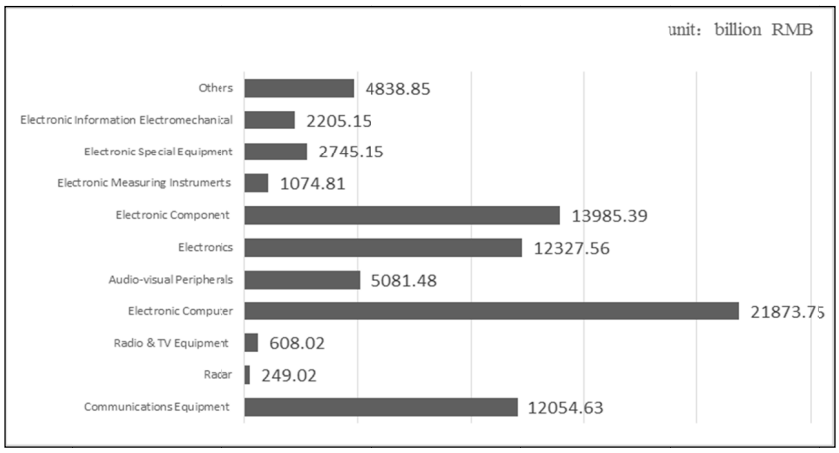

Figure 2. Output values of sub-sectors for Mainland's electronic information manufacturing industries in 2011

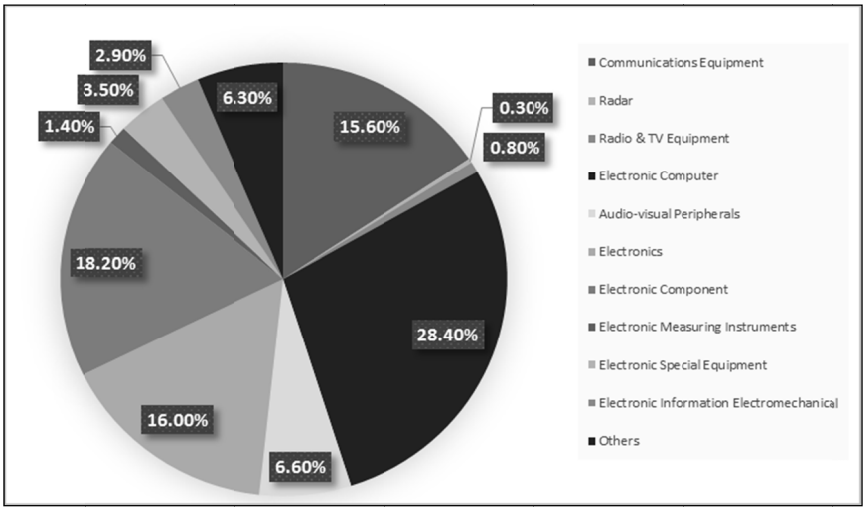

Figure 3. Proportion of output values of sub-sectors for Mainland's electronic information manufacturing industries in 2011

Source: China Information Industry Yearbook in 2012, made by the Editorial Committee of China Information Industry Yearbook, Electronic Industry Press, Dec., 2012.

In 2011, total output for Taiwan information and electronics industry came to 5301.326 billion new Taiwan dollars, equivalent to 1104.531 billion yuan, around one seventh of Mainland's output at the same term. The output came to 3870.89 billion new Taiwan dollars for electronic component industry (including five types of products in semiconductor, passive electronic components, printed circuit board, photoelectric materials and other electronic components), accounting for 73.02%; the output was up to 1430.426 billion new Taiwan dollars for computer, electronic products and optical product industries (including other types except five types of products in Fig. 2.7), accounting for 26.98% (Note 1). From internal sub-sectors, the four industries—semiconductor, optical materials and components, computer and peripheral devices, and communications equipment took up the first four positions, up to 1501.802, 1480.119, 518.813 and 568.453 billion new Taiwan dollars respectively (Fig. 4), accounting for 28.3%, 27.9%, 10.7% and 9.8% (Fig. 5) respectively, totally 76.7%. Apparently, the electronic components industry in two types of main products—semiconductor, and optical materials and their components is a main part of Taiwan information and electronic industry.

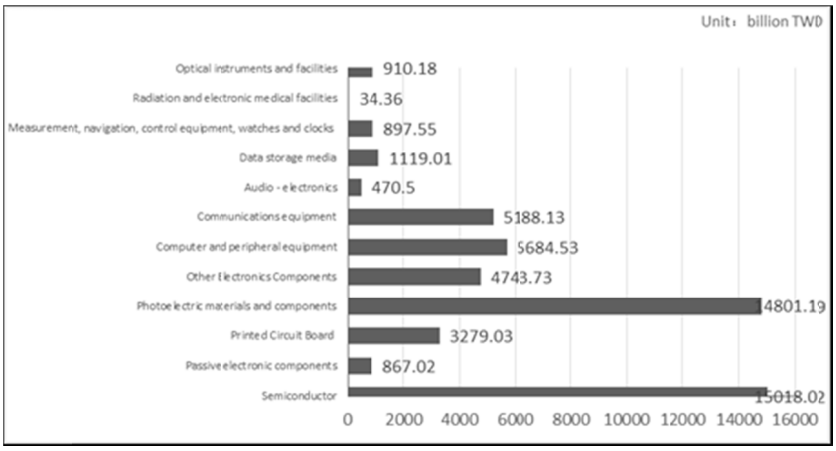

Figure 4. Output values of sub-sectors for Taiwan information and electronics industry in 2011

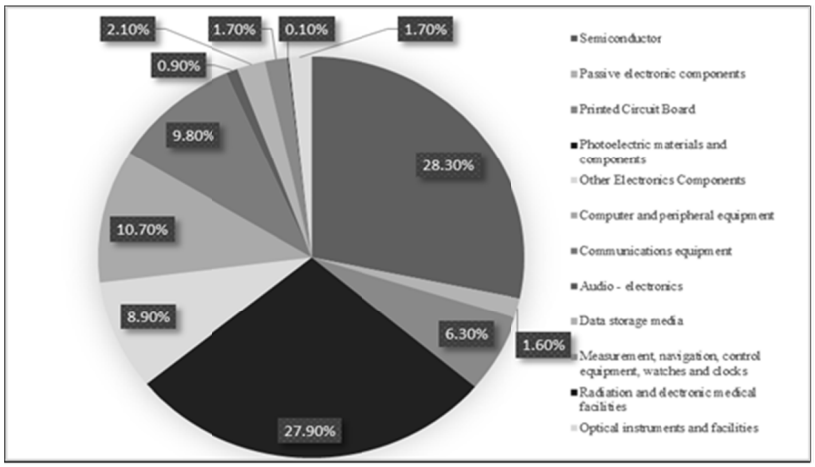

Figure 5. Proportion of output values of sub-sectors for Taiwan information and electronics industry in 2011

Source: Industry, Commerce and Service Census of Taiwan 2011.

For comparison, according to the cross-strait electronic information manufacturing classification standard, the sub-sectors in cross-strait electronic information manufacturing are classified into five classes by and large, namely, electronic computer, communication equipment, audio-visual electronic devices, electron components and others. Table 2 shows output and proportion of five classes for cross-strait electronic information manufacturing in 2011.

Table 2. Comparison of outputs of five classes for cross-strait electronic information manufacturing in 2011

Class of industry	Mainland		Taiwan	
	Output value (proportion (%)) (10^9 yuan)	Proportion (%)	Output value (10^9 NTD)	Proportion (%)
Electronic computer	21873.75	28.39	5684.53	10.72
Communication equipment	12052.63	15.64	5188.13	9.79
Audio visual electronic devices	5081.48	6.60	470.50	0.89
Electronic components	26312.95	34.15	38708.99	73.02
Others	11722.11	15.22	2961.11	5.59

Source: reproduced from research.

In order to evaluate difference in cross-strait electronic information manufacturing structures, the

index—discrepancy coefficient of the structures is defined here. The formula is as follows:

$$D_{mt} = 1/2\sum_{j=1}^{n}\left|\frac{ICT_{mj}}{ICT_m} - \frac{ICT_{tj}}{ICT_t}\right| \quad (1)$$

Where, D_{mt} stands for discrepancy coefficient of cross-strait electronic information manufacturing structures, ICT_{mj} and ICT_{tj} represent output values of *j* subsector in cross-strait electronic information manufacturing respectively, and ICT_m and ICT_t are total output values of cross-strait electronic information manufacturing respectively. D_{mt} value ranges from 0 to 1. The bigger the value is, the bigger the discrepancy of cross-strait electronic information manufacturing is. Based on this method and Table 2.6, the discrepancy coefficient of output value structures for cross-strait electronic information manufacturing industries is 0.3887, apparently higher than the discrepancy coefficient (0.2541) of structure for two sides' three-industry structures and the discrepancy coefficient (0.1261) of cross-strait manufacturing structures. This indicates nearly three fourths of output value for Taiwan electronic information manufacturing is from electronic components (electronic parts and components). On the other hand, this means a high complementarity in development of cross-strait electronic manufacturing.

Businessmen's business is an expansion of Taiwan industries in Mainland. They can not only contribute to cross-strait trade, but also drive the two sides' trade development indirectly. Different industries have different trade growth in investment, where, more remarkable trade growth is available in plastics, metalwork, electronic and electrical machines, and precision instruments invested by Taiwan businessmen, whereas no significant growth effect occurs in such conventional industries as food and beverages.

The trade across the Taiwan Straits is at full speed in the past 20 years with investment from Taiwan businessmen. Based on statistics from Mainland customs departments, the cross-strait trade volume was 7.41 billion dollars in 1992, and increased 26-fold to 198.31 billion dollars in 2014, with an average annual increment of 16.1%. According to statistics from Taiwan customs departments, the cross-strait trade volume came to 130.16 billion dollars from 11.667 billion dollars from 1992 to 2014, with an average annual increment of 11.6%. At present, Mainland becomes the first trade partner and product export place for Taiwan, while Taiwan is the seventh trade partner and the fifth import source for Mainland.

From cross-strait electronic product trades, Table 3 shows that from 2003 to 2014, the trade amount for cross-strait electronic products increases to 77.961 billion dollars from 19.857 billion dollars, with an average annual increment of 13.2%. The trade amount for electronic products accounts for 57.13% to the minimum in total product trading amount in 2005 and 2008; 60.82% to the maximum in 2010, 59.90% in 2014, always maintaining around six folds or so at a higher level. This indicates the electronic products play the leading part in cross-strait trades.

Table 3. Cross-strait electronic products trading during 2003-2014

Item	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
HS84	61.26	82.15	83.93	91.81	99.59	101.66	78.42	120.95	135.57	125.86	125.42	133.86
HS85	99.38	147.65	188.17	240.15	270.65	278.29	256.85	369.26	425.41	422.01	444.40	485.64
HS90	37.93	79.52	92.01	112.52	151.00	181.46	132.60	196.33	189.49	181.07	169.95	160.11
Total	198.57	309.32	364.11	444.47	521.24	561.41	467.87	686.53	750.47	728.94	739.77	779.61
All	339.09	531.42	637.37	765.92	904.32	982.75	786.72	1128.81	1275.57	1216.23	1243.77	1301.60
Proportion	58.56	58.21	57.13	58.03	57.64	57.13	59.47	60.82	58.83	59.93	59.48	59.90

Data source: Statistical database inquiry of Department of Customs, Ministry of Finance, Taiwan. (Note 2).

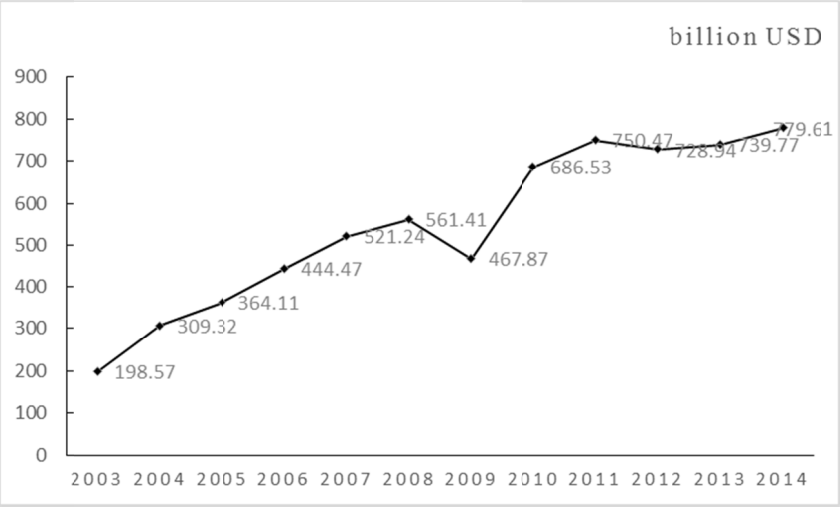

Figure 6. Total trade amount changes for cross-strait electronic products during 2003-2014

Source: Statistical database inquiry of department of customs, ministry of finance, Taiwan.

From changing trend in Fig. 6, there is a remarkable growth as a whole in cross-strait electronic products trade in the past ten years, and it keeps a rise trend currently. It is estimated that the electronic products still take a lead in cross-strait trades in the future, indicating a further integration is needed in cross-strait information technology industry.

However, the industrial integration faces more challenges similarly. In particular, the face-to-face communication is necessary frequently on design and technology, disclosure of trade secrets, and communication and cost for manufacturing and design at the early stage in transregional cooperation. The cross-strait ICT industries should solve and consult commonly the problems how to avoid trade secret disclosure, reduce information cost, and gain the benefit in specialization for in new information technology, network technique and manufacturing. Thus, the integration should be done in following four paths.

5.1 Establishing and Continuously Enriching Common Industrial Standards

Since 2005, the cross-strait information industries took turns to hold a forum, and total 288 consensuses have been reached up to now, releasing 30 common standards. On the basis of achieved accomplishments, more consultations should be made in the future further to improve cross-strait common standards in information and network technologies, change cross-strait industrial standards into international ones, and win more speaking rights in the increasing market competition.

5.2 Forging Closer Benefit Community by Capital

For a long time, Taiwan businessmen funded solely their enterprises in Mainland for the most part. There is no exception for the investment for electronic information industry. It is shown in Table 4, that according to the investigation report from Chung-Hua Institution for Economic Research (CIER), the solely-invested firms made up 87.62% in Taiwan businessmen enterprises investing to Mainland electronic information in 2013. In the enterprises in cooperative form of investment, they cooperated mostly with Taiwan firms (5.50%) and foreign enterprises (4.13%), as well as less cooperated relatively with local private enterprises (3.67%), local state-owned enterprises (1.34%), and local governments (0.46%). This demonstrates the cross-strait electronic information industries cooperate still in a loose state to the present.

Table 4. Forms of Taiwan businessmen investment enterprises in Mainland electronic information industry in 2013 (Note 3) (Unit: Enterprise, %)

Form of enterprise	Electronic components manufacturing	Computer, electronic products and optical products manufacturing	Information and communication industry	Electronic information industry
Sample size	142	67	9	218
Sole proprietorship	88.03	89.55	66.67	87.62
Enterprises cooperating with Taiwan firms for investment	7.04	1.49	11.11	5.50
Enterprises cooperating with local Taiwan businessmen firms	1.41	2.99	0.00	1.84
Enterprises cooperating with local state-owned firms	0.70	2.99	0.00	1.37
Enterprises cooperating with local private firms	4.93	1.49	0.00	3.67
Enterprises cooperating with local governments	0.00	1.49	0.00	0.46
Enterprises cooperating with foreign firms	4.23	4.48	0.00	4.13
Enterprises cooperating with Taiwan individuals	0.00	0.00	11.11	0.46
Enterprises cooperating with local individuals	0.00	1.49	11.11	0.92
Three-processing and one compensation	0.70	0.00	0.00	0.46
Others	2.82	0.00	0.00	1.84

Data source: Report of Investigation and Analysis on Business Operations of Overseas Investment compiled by the Chung-Hua Institution for Economic Research (CIER) in 2014.

The solely-funded organization form can be better fit for complementary-type market environment, but difficultly fit for competitive market environment. It is becoming an institutional obstacle to restrain Taiwan businessmen for further developing and growing. In changing environment, objectively the cross-strait electronic information enterprises need a close cooperative way to form benefit community, so as effectively to resolve the conflict of interest in reality, avoid mutual cutthroat competition and jointly promote industrial competitiveness. Specifically, by the joint-ventured or cross-shareholding way, the cross-strait electronic information firms are required to form close benefit communities to share risks, profits and losses, and deal with the problems in mechanisms in benefit sharing and rational allocation between cross-strait enterprises.

5.3 Further Close Industrial Chain Specialization and Cooperation

From the trade perspective, the inter-industry trade is always top dog in cross-strait electronic products trading as a whole, but this trading presents a development trend to intra-industry trade in the past decade. For patterns of specialization in intra-industry trade, the vertical labor division which is dominant in Taiwan is in priority for cross-strait electronic products in investigation, but the two sides' horizontal labor division increases in proportion to some extent. This means shrinking the quality gap in cross-strait electronic products and enhancing the product competitiveness.

Both stable cross-strait industrial chain and rational industrial specialization are better not only for cross-strait industries integrated deeply into global production network, but also for sound development of cross-strait economic relation. So the cross-strait electronic products shift from inter-industry labor division to intra-industry one, and the intra-industry horizontal labor division is enhanced step by step. In the future, the cross-strait electronic products will be driven from resource-complementing specialization and cooperation to functional one. In the horizontal labor division, two sides should scale up efforts for the policies in industrial consultation, fully exploit own characteristics and give play to their own advantages to form synergetic development in differentiation and characteristics. Moreover, both sides should jointly invest for brand R&D, and pay attention to and continue supporting Taiwan businessmen's development in Mainland.

5.4 Joint R&D for Breakthrough of Major Core Technologies

At the age of economic globalization, more and more innovative subjects start to apply open R&D innovative pattern. They search technical innovative sources, strengthen R&D alliance, promote university-industry cooperation, and take advantage of risk funds and governmental resources in the world. By this, they integrate internal and external resources and maintain R&D activities full of energy. Inter-competition between cross-strait information industries is to the benefit of efficient R&D, but both sides are faced with the "low-end lock" bottleneck. It is necessary to make a breakthrough by joint R&D. To promote joint R&D, two sides should first make clear cooperative foundation, and achieve bigger breakthroughs in R&D and cooperative platform. Furthermore, both sides should innovate the R&D and cooperative patterns actively, carry out open R&D innovation and cooperation, and jointly explore development road of collaborative innovation.

6. Conclusions

Currently, the new round of industrial revolution based on new information technology and profound applications reveals its importance for the first time. It will bring unprecedented opportunities for cross-strait ICT industry to get rid of the "low-end lock" dilemma. The profound cooperation in industrial integration is an effective path to promote cross-strait ICT industry's position in international specialization. In integration, the cross-strait ICT industry faces challenges of uncertainties in core technology breakthrough, multi-track operation in Asia-Pacific regional economic integration and changes of Taiwan political situation. Driving the integration of cross-strait electronic information industries should start with establishing common industrial standards. On the basis of capital integration and further specialization and cooperation of industrial chains, both sides should jointly make breakthroughs in major core technologies, and achieve overall integrated development step by step.

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Notes

Note 1. Taiwan electronic information industrial data involved all come from the Statistical Tables of Preliminary Survey Results for Industry & Commerce and Service Industry in 2011.

Note 2. HS stands for the Harmonized Commodity Description and Coding System. By HS, the electronic products refer to HS84 (nuclear reactor, boiler, machine, mechanical tools and their components); HS85 (electrical motor, electrical equipment and its components; recorder & tape reproducer, film and TV, voice recorder & playback and their components, accessories); and HS90 (optics, photograph, measurement, inspection, precision instrument, instrument and equipment for internal medicine or surgery; parts and accessories of above-said articles).

Note 3. Because this questionnaire is made with multi-choice questions, the sum for all items exceeds 100% in proportion.