Analysis and Investigation of Information Science Education in China

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ABSTRACT
Starting from the beginning of the University of Science and Technology founded in 1958, Information Science education in China has gone through nearly 60 years. In this paper, the development of Information Science education in China is deeply studied. First, three stages of the development of Information Science education in China are summarized. Then a comprehensive research on the current situation of colleges and universities which recruit students majoring in Information Science is carried out. And the relevant indicators that reflect the development of Information Science education of these schools are analyzed in detail. Finally, on the basis of the summary of the full text, some suggestions for the future development of the Information Science education in China are put forward.

KEYWORDS
Information Science · education· research progress· colleges and universities· China

INTRODUCTION
After World War II, along with the development of intelligence activities and intelligence work, Information Science has gradually been developed into a new discipline. In December 1957, the journal Scientific Intelligence Work (the predecessor of China Information Review) was started publication by the Institute of Scientific and Technical Intelligence of China (the predecessor of Institute of Scientific and Technical Information of China), marking the beginning of the study of Information Science in China. Information Science education in China goes back to 1958, University of Science and Technology Intelligence was founded under the organization of the Compiling and publishing Committee of the Chinese Academy of Sciences. But the university was incorporated into the University of Science and Technology of China and became one of its faculties, the Department of Scientific Intelligence, in August 1959 (Information Education, 2015). Although the education of Information Science in China started earlier, it was caught in a pause after a very short development due to the influence of some social factors. Until 1978, with the development of reform and opening up, Information Science education in China has really entered a period of rapid development.
After more than half a century of development, the education of Information Science in China has formed a complete education system with a certain scale, a complete hierarchy and a reasonable structure, and has played a key role in cultivating high-level talents in the field of Information. In order to objectively reflect the current situation of the development of Information Science education in China, colleges and universities which recruit students majoring in Information Science were taken as the breakthrough point to carry on depth analysis and research.

LITERATURE REVIEW
As early as 1983, Yan, Y. M. (1983) analyzed the current situation of Information Science education in China from a macro point of view, and discussed the importance of strengthening the education of Information Science to revitalize the economy. Dong, X. Y. (1996) analyzed the social and economic factors that affect the Library Science and Information Science education in the 1990s, and summarized the problems and development trends in the transformation of Library and Information Science education in China. Peng, F. Z. (2000) concluded that the graduate education of Library Science and Information Science in China has made great achievements after twenty years of reform and opening-up, and we also need to work hard to adjust the structure, optimize the training program, improve the quality of education and cultivate qualified innovative talents in the new century. Wang, Z. J. (2001) concluded that the characteristic of Library Science and Information Science education in China was first to try to integrate, and then to differentiate in the 1980s and 1990s. Qiu, J. P. et al. (2002) reviewed and summarized the three development stages and characteristics of Information Science education in China since the reform and opening up, and discussed the development trend of Information Science education in 21 century. Lai, M. S. (2003) summed up the current situation of Information Science education in the United States, UK, Japan, Korea, Europe and China, and discussed the existing problems in education of Information Science in China. Wang, Z. J. et al. (2005) collected and sorted out the data of 45 organizations of graduate education of Information Science from 1984 to 2004, and gave a systematic analysis of the development trend of graduate education of Information Science in China. By analyzing the present situation of the graduate education of Information Science in China, Ma, F. C. and Lu, B. (2006) summarized the achievements, pointed out the existing problems and put forward the corresponding countermeasures, and finally prospected the development trend of the graduate education of Information Science. Taking the three decades after the reform and opening up as the clue, Chen et al. (2008) combed the development history and the achievements of Library Science and Information Science education in China, and put forward the relevant recommendations combined with the changes in the environment. Through the network investigation and literature research method, Wang et al. (2010) reviewed and analyzed the development course of thirty years (1978 – 2008) of Library and Information Science education in China, and divided the thirty years into five stages: recovery, development, wandering, adjustment and improvement based on iconic events. Xu, F. (2011) made some thoughts on the basic problems of modern Information Science from five aspects: the discipline mission, the research object, the discipline nature, the research contents and the discipline system. And she tried to construct the discipline system of modern Information Science from four aspects such as theory, application, technology and management. By analyzing the environment, challenges and countermeasures of Library and Information Science education, Wei, J. Z. (2012) summarized the research achievements in the reform of international Library and Information Science
education since 2005. Ma, F. C. (2013) believed that there is a close relationship between Information Science, Library Science, Bibliography, and Information Systems Science. He discussed the development of Information Science, and summed up the nine major frontier issues to be studied in the future, combining with the current situation of the discipline development and environment. Wu, D. and Yu, W. T. (2015) reviewed the evolutional process of LIS educational idea and investigated the current situation of Library and Information Science education from 2010 to 2014, and summarized the main trend of development in view of new challenges and new requirements arising from the era of big data and information technology.

THE THREE STAGES OF INFORMATION SCIENCE EDUCATION IN CHINA

According to the change of major name, the development process of Information Science education in China can be divided into three stages.

(1) The stage of Science and Technology Intelligence Science (From 1958 to August 1992). Information Science education in China began with the founding of the University of Science and Technology in 1958, but was not fully developed until the reform and opening up. By the early 1990s, it has formed a more complete education system, including short-term training courses, correspondence courses, junior college education, undergraduate education, and postgraduate education. At this stage, the position of Information Science as an independent discipline was gradually stable, and this laid a solid foundation for the later development of the Information Science education. This is the initial stage of the education of Information Science in China.

(2) The stage of Science and Technology Information Science (From September 1992 to 1997). In the 1990s, the development of information technology made the Information Science education meet new challenges. The existing Information Science education at that time, which focused on document information, had been unable to meet the needs of the society. In September 1992, “Science and Technology Intelligence” was renamed “Science and Technology Information”, decided by the National Conference on Science and Technology Information. In the following year, the major name of Science and Technology Intelligence was adjusted to Science and Technology Information in the Colleges and Universities Undergraduate Specialized Catalog promulgated by the State Education Commission. Against this background, the research object of Information Science education in China was expanded, and its research field has been extended and developed to the field of information. Then the boundary between Information Science and other subjects in the field of information became increasingly blurred, so that its professional caliber became wider and wider. In this stage, the Information Science education in China has entered into a period of rapid development.

(3) The stage of Information Science (since 1997). In 1997, the State Council and the State Education Commission jointly issued the Lists of Disciplines and Majors of Master and Doctoral Degrees as well as Post Graduate Education, including the first-class discipline "Library, Information and Archives Management" which contains 3 second-class disciplines of Library Science, Information Science and Archival Science. In July 1998, Information science was removed from the Colleges and Universities Undergraduate Specialized Catalog revised by the Ministry of education. Since then, Information Science has been elevated to a higher level of graduate education. This stage made clear the discipline status of Information Science and the level of Information Science education in China. The Information Science education in China follows the pace of social development to meet the needs of the times,
further adjusts the professional research direction, and actively carries out the national level quality course and MOOC teaching to realize the sharing of high quality teaching resources, and continuously pushes forward the innovation of educational model. At the same time, it attaches great importance to international exchanges and cooperation. It aims to train high-level professionals with innovative spirit and practical ability to adapt to the new technology environment. It indicates that the development of Information Science education in China has become more mature and perfect.

THE PRESENT SITUATION OF COLLEGES AND UNIVERSITIES

According to the Evaluation Report on Graduate Education and Disciplines in China (2014-2015), there are 58 colleges and universities in China which set up the Information Science major, and recruit graduate students. It is also necessary to specify that the evaluation targets of the Evaluation Report mentioned above do not include military academies and any scientific research institutions other than universities. The specific colleges and universities and their geographical location are shown in Table 1.

From table 1, we can see that about 41.38% of the total number of colleges and universities are located in East China. And only 2 universities, Xidian University and Lanzhou University, are located in the Northwest of China. Thus, the regional distribution of these colleges and universities in Table 1 is very uneven, colleges and universities mainly concentrated in the eastern coastal and central cities, while the number of colleges and universities in the western region is relatively small, which is consistent with the phenomenon of uneven regional distribution of Chinese universities. For a better understanding of the development of those schools in Table 1, the relevant indicators that reflect the development of Information Science education, including the graduate enrollment scale, basic educational resources, scientific research capacity and research directions, are investigated and analyzed.

The enrollment scale of Information Science education

By inquiring the enrollment plan of each university in 2015, we counted the doctoral students and master students enrollment scale of Information Science major in 58 colleges and universities, and drew a column chart - line diagram. Due to space limitations, detailed data and figure are not displayed in the paper.

Through analysis, we could have a clearer understanding of the enrollment scale of each university. In 2015, a total of 440 master students would be planed to be recruited. Huazhong Normal University, which planned to recruit 38 master students, ranked first in the number of enrollment. Renmin University of China, Beihang University and Lanzhou University were only planning to recruit 1 master student. And Tongji University, Shanghai Jiao Tong University and Chongqing University would not plan to recruit students in 2015. By contrast, a total of 43 doctoral students would be planed to be recruited. Wuhan University, Nanjing University, Peking University, Renmin University of China, Huazhong Normal University, Nankai University and Jilin University are the 7 universities with the qualification of recruiting doctoral students in Information Science. Wuhan University which planned to recruit 14 doctoral students, ranked No.1 in the 7 universities. Nankai University and Renmin University of China both planed to recruit 2 doctoral students. In addition, the 7 universities accounted for only 12.07% of the total number of schools, but their cumulative enrollment scale was up to 25.45% of the total. This shows that the 7 universities have made great contributions to the cultivation of talents in the field of Information Science in China.
Table 1. 58 Colleges and universities and their geographical location

<table>
<thead>
<tr>
<th>Region</th>
<th>Province</th>
<th>Colleges and Universities</th>
</tr>
</thead>
<tbody>
<tr>
<td>East China</td>
<td></td>
<td><strong>Nanjing Province(8)</strong>: Nanjing University, Nanjing Science and Technology University, Nanjing Agricultural University, Nanjing University, Hohai University, Nanjing University of Aeronautics and Astronautics, Southeast University, Soochow University</td>
</tr>
<tr>
<td></td>
<td>Shandong Province(5)</td>
<td>Shandong University, Shandong University of Science and Technology, Qingdao University of Science &amp; Technology, Shandong University of Technology, University of Jinan</td>
</tr>
<tr>
<td></td>
<td>Shanghai City (5)</td>
<td>East China Normal University, Shanghai University, Tongji University, East China University of Science and Technology, Shanghai Jiao Tong University</td>
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<tr>
<td></td>
<td>Fujian Province(2)</td>
<td>Fuzhou University, Fujian Normal University</td>
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<tr>
<td></td>
<td>Anhui Province(2)</td>
<td>Anhui University, Anhui Finance and Economics University</td>
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<tr>
<td></td>
<td>Zhejiang Province (1)</td>
<td>Zhejiang University</td>
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<tr>
<td></td>
<td>Jiangxi Province (1)</td>
<td>Nanchang University</td>
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<tr>
<td>North China</td>
<td></td>
<td><strong>Beijing City (6)</strong>: Peking University, Renmin University of China, Beijing Normal University, China Agricultural University, Beijing Institute of Technology, Beihang University</td>
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<tr>
<td></td>
<td>Tianjin City (3)</td>
<td>Nankai University, Tianjin University, Tianjin Normal University</td>
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<tr>
<td></td>
<td>Shanxi Province(2)</td>
<td>Shanxi University, Shanxi University of Finance and Economics</td>
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<tr>
<td></td>
<td>Hebei Province (1)</td>
<td>Hebei University</td>
</tr>
<tr>
<td>Central China</td>
<td>Hubei Province(3)</td>
<td>Wuhan University, Huazhong Normal University, Huazhong University of Science and Technology</td>
</tr>
<tr>
<td></td>
<td>Henan Province(3)</td>
<td>Zhengzhou University, Zhengzhou University of Aeronautics, Xinxiang Medical University</td>
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<tr>
<td></td>
<td>Hunan Province (2)</td>
<td>Central South University, Xiangtan University</td>
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<tr>
<td>The Southwest of China</td>
<td>Sichuan Province (2)</td>
<td>Sichuan University, Southwest University of Science and Technology</td>
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<td></td>
<td>Chongqing City (2)</td>
<td>Southwestern University, Chongqing University</td>
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<tr>
<td></td>
<td>Yunnan Province (1)</td>
<td>Yunnan University</td>
</tr>
<tr>
<td>The Northeast of China</td>
<td>Jilin Province (2)</td>
<td>Jilin University, Northeast Normal University</td>
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<td></td>
<td>Heilongjiang Province (1)</td>
<td>Heilongjiang University</td>
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<td></td>
<td>Liaoning Province(1)</td>
<td>China Medical University</td>
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<tr>
<td>South China</td>
<td>Guangdong Province (2)</td>
<td>Sun Yat-sen University, South China Normal University</td>
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<td></td>
<td>Guangxi Province (1)</td>
<td>GuangXi University for Nationalities</td>
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<tr>
<td>The Northwest of China</td>
<td>Shaanxi Province (1)</td>
<td>Xidian University</td>
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<td></td>
<td>Gansu Province (1)</td>
<td>Lanzhou University</td>
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Basic educational resources of Information Science education

In order to analyze the basic educational resources of Information Science major in 58 colleges and universities, the basic educational resources evaluation indicators collected in the Evaluation Report, including the number of degree points, the number of key disciplines, faculty, research projects, research funding and research base, were used to draw a column chart (Due to space limitations, detailed data and figure are not displayed.).

The index value is calculated by giving a certain weight to the basic educational resources evaluation indicators mentioned above. Among 58 schools, the index values of Wuhan University, Nanjing University, Chongqing University, Huazhong Normal University and Renmin University of China are all above 30; the index values of Peking University, Anhui University, Jilin University, Beijing Institute of Technology and Nankai University are
all between 20 and 30; the index values of 11 universities, including Heilongjiang University, Beijing Normal University, etc., are between 10 and 20; and the index values of the remaining 37 universities are below 10. We can know that the basic educational resources of Information Science major in most schools are in a medium or general level. In order to enhance the competitiveness and the training level of Information Science major in China, it is necessary to increase the investment and construction of basic educational resources.

**Scientific research capacity of Information Science education**

In the field of Information Science, the main form of scientific research outputs is academic papers. Academic papers are the crystallization of researchers’ labor and wisdom, and the total amount of academic papers of one institution can be used to measure the scientific research capacity of the institution. Moreover, the number of academic papers published in Nature/Science/Cell, the number of ESI top papers and highly-cited papers as well as the number of academic papers indexed in SCI/SSCI/A&HCI/ EI/CSTPC/CSSCI, can reflect the scientific research capacity of the subject in a certain degree. In order to understand the scientific research capacity of Information Science major in 58 colleges and universities, the relevant data of scientific research outputs collected in the *Evaluation Report* was used to draw a column chart (Due to space limitations, detailed data and figure are not displayed.).

The index value is also calculated by giving a certain weight to the academic papers. We can see that the scientific research capacity of 58 schools is diverse from each other. Among them, the index values of 7 schools, including Wuhan University, Shanghai Jiao tong University, Beihang University, Zhejiang University, Huazhong University of science and technology, Nanjing University and Peking University, are all more than 60. The index values of 7 schools, including Tongji University, Chongqing University, Central South University, Sun Yat-sen University, Southeast University, Xi'an Electronic and Science University and Sichuan University, range from 40 to 60. The index values of 12 schools, including Renmin University of China, East China Normal University, Shanghai University, Beijing Normal University, Soochow University, etc., range from 20 to 40. The index values of the remaining 32 schools are all below 20. Thus it can be seen the scientific research capacities of the major in majority of schools are low, and they need to be further improved.

**Research directions of Information Science education**

Through inquiring admissions catalog for postgraduate students of Information Science major, we can effectively understand research directions of the major in each school. It can reflect the characteristics of different colleges and universities as well as the advantages of supervisors in this field (Zhang et al., 2010). Thus, we investigated the admissions catalog for master graduate students of 58 schools and the admissions catalog for doctoral students of 7 universities in 2015 by the Internet survey. Due to space limitations, the specific research directions of each school will not be listed in this paper.

Through investigation, it can be found that the research directions of Information Science in each school are different. In term of admissions catalog for master graduate students, Nanjing University sets up 14 research directions, and it ranked 1st out of 58 schools. The 14 research directions are respectively Information Science theory and method, competitive intelligence analysis, information processing and information retrieval, information system engineering, business information management, e-commerce, e-government, computer image processing and pattern recognition, information service and information security, multimedia information retrieval, information security and safety,
information resource management, science and technology data and information analysis. Most universities set up 3 to 5 research directions. But some colleges and universities only set up a research direction, such as Beihang University, Soochow University, etc. In term of admissions catalog for doctoral students, the characteristics of each school are not obvious.

The main research directions of each university are as follows Information resource management, competitive intelligence, knowledge management, information retrieval, informatics theory and method, information management method and technology, electronic commerce, information systems, information service, information economy, information analysis, data mining, information organization, scientific evaluation, development and management of network information resources, electronic government, knowledge discovery, information processing, intellectual property, information measurement and information systems engineering, knowledge engineering, information research, information users, information security and protection, etc. In contrast to a previous study (Zhu and Ge, 2008), the current research directions are more extensive and clear. Thus, with the development of science and technology, economic and social progress, China's Information Science education also follows the pace of the times, sets up the relevant research direction in a timely manner and trains lots of outstanding professional talents in line with the social development.

CONCLUSIONS AND SUGGESTIONS
After nearly 60 years of development, Information Science education in China has made considerable progress. In this paper, the development history and current situation of Information Science education in China are reviewed and studied. The main conclusions are as follows.

(1) Through the stage of Science and Technology Intelligence Science and the stage of Science and Technology Information Science, the education of Information Science in China has developed from the embryonic development period to the rapid development period, and then to the leap-forward development period. The position of the subject is steady, and the quantity and quality of talent training in this field is significantly improved. The research field of Information Science has been expanded to the field of information science and technology, which conforms to the demand of the society for the inter-disciplinary talents with wide aperture, thick foundation and high level. The development of Information Science education gradually adapts to the social and economic development, and is in line with international standards. In addition, Information Science education in China also attaches great importance to international exchanges and cooperation.

(2) The Information Science education in China already has a certain enrollment scale, but the development status of different colleges and universities is different. And the whole development levels of the 7 universities with the qualification of recruiting doctoral students in Information Science are more prominent. The basic educational resources of most schools in China are less than satisfactory. Scientific research capacities in different schools are obviously different, and the index value of the vast majority of schools is low. Furthermore, the research directions of each university also have their own characteristics.

From the overall development trend, the development of Information Science education in China is full of vigor and vitality. But through the network investigation of the 58 colleges and universities in China which set up the Information Science major, we find that the development and construction of these colleges and universities are not balanced, which will restrict the development of Information Science education in the future competition of subjects. The following suggestions are put forward for the future development of
Information Science education in China from the perspective of discipline construction. ① Information Science needs to grasp the social demand, and adjust the subject orientation in time. ② Colleges and universities should attach importance to the construction of educational resources. ③ Colleges and universities should continue to promote the innovation of educational model. ④ Colleges and universities need to strengthen international exchange and promote the internationalization of education.

REFERENCES


