China's Potential and the Power of Human Resources

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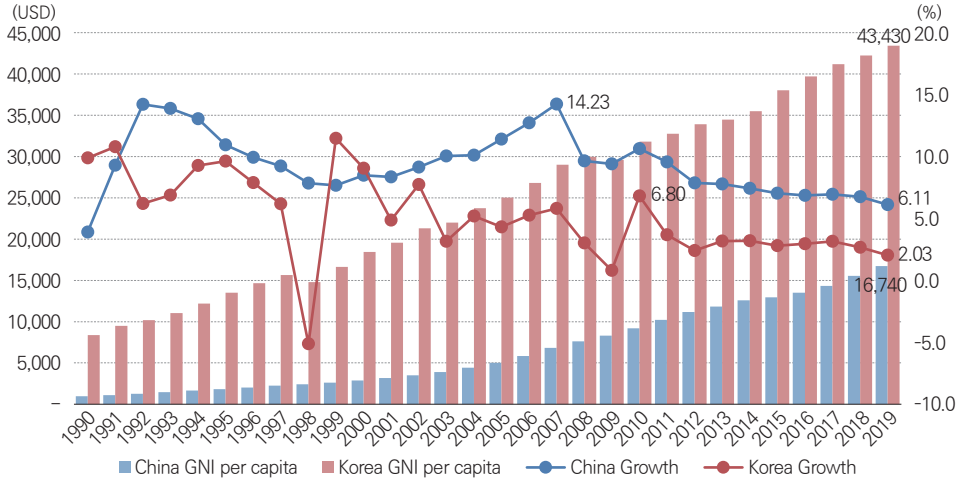
1. Overview of China's Human Capital

The purpose of this study is to determine the historical role of human resources played in China's economic development. After Deng Xiao Ping (鄧小平) opened China in 1978, China's economy has grown drastically and it is still growing very fast compared to other advanced countries. According to the World Development Indicator, China's economy grew at a rate of 6.11 percent last year, while Korean grew at 2.03 percent. Gross National Income (GNI) per capita in Purchasing Power Parity (PPP) term was about 16,740 USD in 2019 in China compared to 43,430 USD in Korea. After World War II, two countries grew rapidly: China and Korea. Ironically, one is communist and the other is a democracy. Thus there can be no doubt that human capital is one of the most important factors behind their development.

Figure 1. Economic Development and Growth in China and Korea



Source: Adapted by the author from World Development Indicator, World Bank.

Many economists have attempted to explain why the economy grows. A long time ago, Solow developed his production model, which explains growth with labor, capital and another input. People substituted that input with technology, geography, urban structure and even institutions. Labor also has been expanded to human capital or skilled labor, etc. Glaeser et al[1] argued for the importance of education using years of schooling, which represents the quality of human capital accumulation. Acemoglu et al[2] said better institutions raise the quality of human capital and all together give rise to economic development. Empirically, they demonstrated the role of human capital in economic development. In addition, Glaeser and Lu[3] published "Human-Capital Externalities in China" in 2018, which insisted higher city-level education led to higher wages in China.

The education fever in China and Korea is already widely known. Even most "tiger moms" (as originally described by Amy Chua, a Chinese-American professor at Yale Law School) in the USA are Asian-American. Ex-president Barack Obama often mentioned Korean education fever as an exemplar and benchmark. Over the past several decades, the concept of human capital has shifted first from labor to skilled labor, then to human resources and then to highly educated human capital, etc. In the agricultural era, the total number population or number of males in the labor force is important, because it represented manpower. On the other hand, literate labor became critical in the industrial revolution era of the18th century because literacy allowed workers to easily share industrial know-how. More recently, literacy in the use of smart devices is becoming much more important, as smartization has progressed. Further, the existence of high-level human capital such as Bill Gates, the founder of Microsoft, or Ma Yun (马云), the founder of Alibaba, etc. is crucial to the competitiveness of nations. A high-end professional is more than just one person, because his or her contribution to society could be tremendous. In this aspect, this study is examine China's human resources and derive some implications for Korea.

2. Population Structure of China

As shown in Figure 2, the population structure by age in China is relatively stable, compared to Korea. For example, the population under the age of five in Korea is about half of the population aged between 30 and 35. Korea has the lowest birth rate among OECD countries. This unbalanced population structure causes two big problems. One is a shortage of human resources in the future. At manufacturing sites, the produc-

1 Glaeser EL., La Porta R., López-de-Silanes F., and Shleifer A. (2004), "Do institutions cause growth", *J. Econ. Growth*, Vol.9, pp.271-303.

2 Acemoglu D., Gallego FA., and Robinson JA. (2014), "Institution, Human Capital, and Development", *Annual Reviwe of Economics*, Vol.6, pp.875-912.

3 Glaeser EL. and Ming L. (2018), "Human-Capital Externalities in China", NBER Working Paper No.w24925.

tivity of aged labor diminishing. The other is social conflicts between generations. For example, what is the policy priority on the welfare issue? With a limited budget, how should government allocate it: more for the young generation education or more for the older generation's medical care? According to the World Population Prospects of the United Nations, the population between ages of five and 40 in China as of 2020 under the One Child Policy is very stable. This means the 5-year population variation is relatively small. Under the age of 30 in China, 5-year population groups range between 82 and 98 million. A stable population structure stabilizes the supply of human resources in the long run.

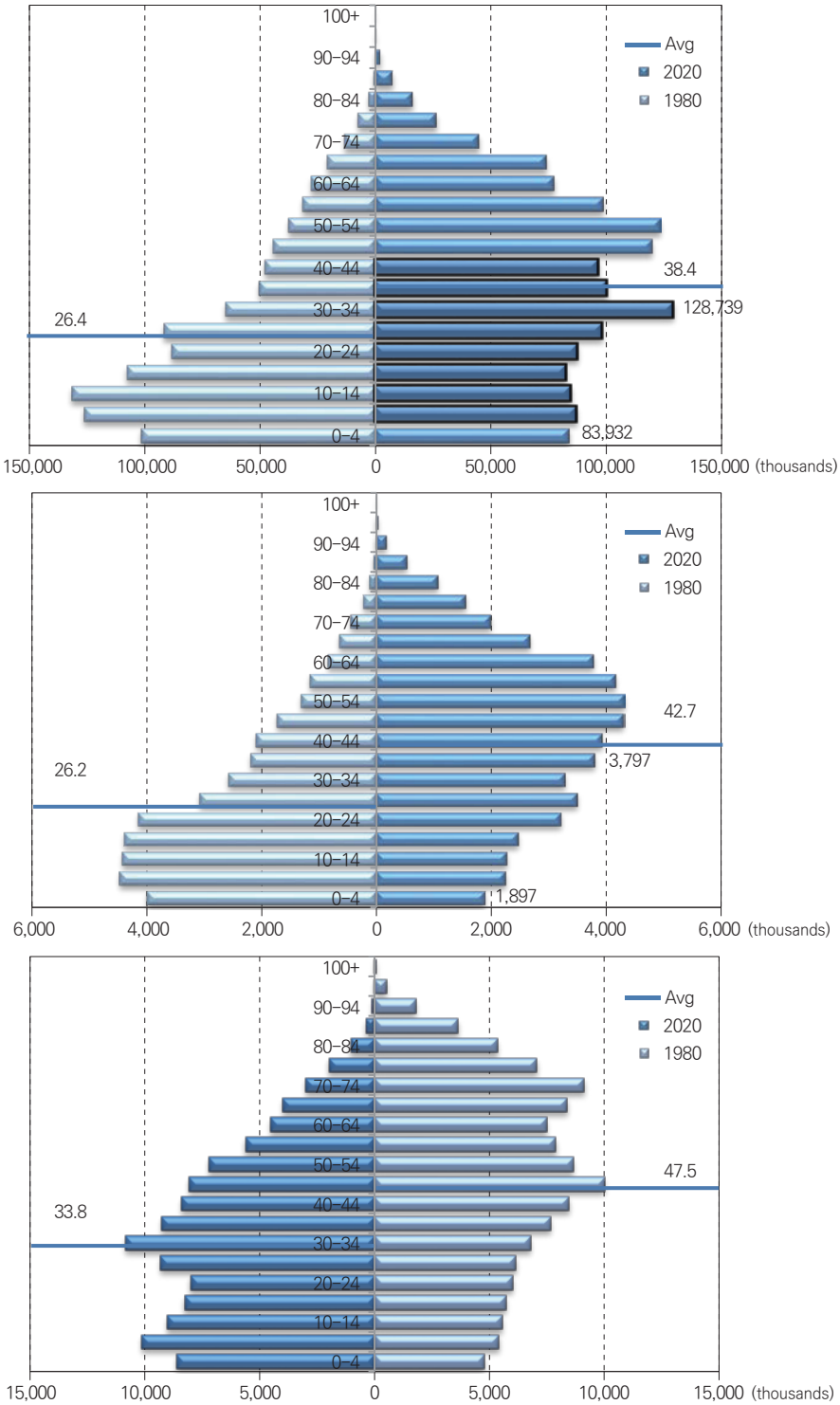
China is also aging fast but not rapidly as Korea or Japan. Often, the population ratio of 65- year-olds to those under 15 is defined as the aging index, which represents the level of aging. According to World Population Prospects data, the aging index in China was 0.432 in 2010 but had jumped to 0.678 by 2020. On the other hand, the aging index in Korea was 0.664 in 2010 before nearly doubling to 1.259 in 2020. This means that there are roughly 25 percent more old people than young people in Korea at this moment. The situation in Japan is much more serious. It faces ultra-aging. The aging index grew from 1.685 to 2.281 between 2010 and 2020. Furthermore, an aging society is defined as a population of which seven percent is over the age of 65. In an ultra-aging society, over 14 percent of the population is 65 or older. Japan is an ultra-aging society: 28.4 percent of the country was older than 65 in 2020. Given these circumstances, the abolishment of the One Child Policy in 2016 was needed to lessen the speed of aging in China.

The 80后 and 90后, born in 1980s and 1990s, respectively, constitute the majority of the One Child Policy generation. They are those in their 30s and 40s in 2020, and the main human capital base in China. Thanks to the abolishment of the One Child Policy in 2016, the 5-year population group of those under the age of four is slightly bigger than the group aged between five and nine. The average age in 1970 was about 24.9, rising to 26.4 in 1980 and 35 in 2010. In 2020, the average age is about 38.4 in China. This rapid aging causes not only aging labor but also increasing social costs for the old. That is the principal reason behind China's abolishment of its signature anti-natal policy. The population of China's Z generation, born in between 1995 and 2005 and often called digital natives, is about 170 million in 2020. In Korea they number 5.7 million. The population ratio of the Z generation in Korea to China is about 3.36 percent, while the total population ratio is about 3.56. It means China has relatively more digital natives than Korea has at this moment.

3. Human Resources of China

Recently, the literacy rate is only an issue in less-developed countries. China's literacy rate is over 95 percent, which means communication in written language is no longer a challenge. Af-

Figure 2. Population Structure of China by Age (China, Korea, Japan)



Source: Adapted by the author from World Population Prospects 2019, United Nations.

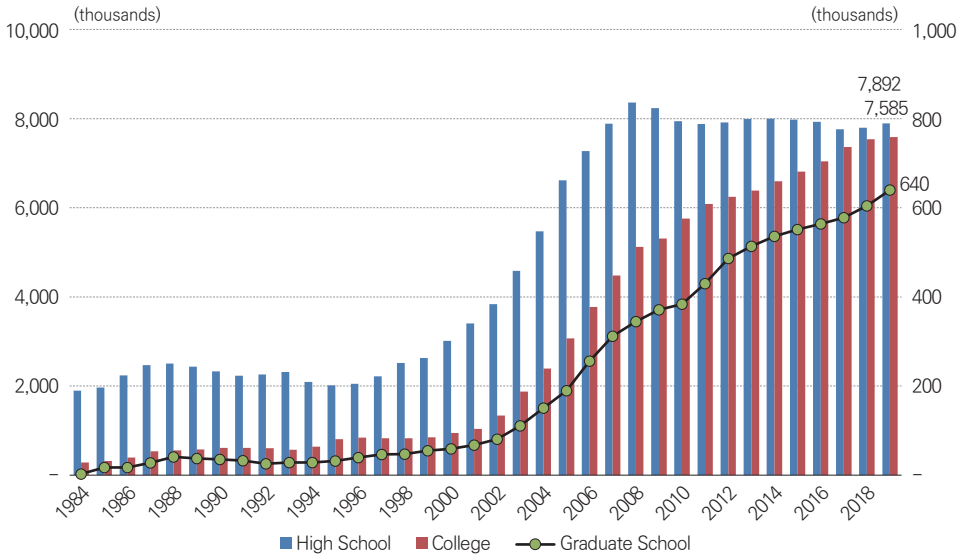
ter the 18th century industrial revolution, people shared knowledge through reading and writing skills. But at that time, the Chinese people were struggling to learn written Chinese, a logographic script. Chinese was a most difficult language to learn before Zhou You Guang (周有光) created Pinyin (拼音), a Romanized alphabet, in the late 1950s. As Pinyin standardized sounds, various dialects converged, forming a lingua franca (普通话), raising the literacy rate. I believe this literacy played a key role in the development of China since late 1970s. Of course the main reason for this development is the Opening China Policy, led by Den Xiao Ping in 1978. The other reason, not widely known, is Pinyin. In 1980s, the main industrial labor force in at that point in their 20s and 30s were educated in Pinyin, which created synergies among industries.

Communication with smart devices such as smartphones or personal computer is another language in digital era and in high demand because people who can use those devices well are able to share knowledge and spread out. The youngest generation are often called "digital natives", which means they have grown up with digital devices. In this respect, China is an early adopter. Most people use smart phones and communicate each other through WeChat (微信; multi-purpose messaging, social media, and mobile payment system). Even illiterate aged people communicate each other by using voice chatting and give allowances to their grandchildren through Alipay or WeChat pay and call cabs through Didichuxing (滴滴出行), a ride-hailing application. The ability of a country's people to capably use digital devices represents the quality of its human resources.

There is another way to measure the quality of human resources, which is education. Many academic papers have tried to prove that years of schooling is an important factor driving economic growth. It is especially important in less developed countries, while higher education (or tertiary education) is important in developing and developed countries. In general, higher education refers to a 2-year college program, a 4-year university curriculum and graduate school education. In the information era, more advanced human capital plays a key role in the economic development. The number of graduates holding advanced degrees in China has been increasing drastically. As shown in Figure 3, 7.6 million Chinese graduated from 2-year and 4-year college programs in 2019. The number of people graduating with advanced masters and doctoral degrees stood at about 640,000 in 2019. Since 2012, the total number of graduates holding bachelor's degrees in China is almost equal to the total population of Korea. Due to the sheer volume of human capital with higher education, the probability of high-level human capital such as Ma Yun emerging is relatively higher.

In general, the ratio of a population with postsecondary education is used frequently. The absolute number of people educated in higher education programs is also very important, because scaled advanced human capital fuels a

Figure 3. Number of Graduates in China by Degree



Source: 2020 China Statistical Abstract, National Bureau of Statistics of China.

nation's competitiveness. In this aspect, China has an abundant advanced human capital pool. It could represent latent potential.

4. Power of Human Capital in China

In 2010s, the fourth industrial revolution commenced. High technologies such as artificial intelligence, big data, cloud computing, the Internet of Things and others are critical to future industrial competitiveness. After COVID-19, the digital world is coming faster than expected. Under these circumstances, high-level human capital such as STEM (science, technology, engineering, and math) postgraduates are key factors driving economic growth.

Table 1 shows the preferred majors of Chinese college freshmen. According to a survey of Chinese college students who enrolled in 2019, the top ranked major is computer science. electrical engineering and automation engineering rank third and fourth, respectively. Several engineering majors are ranked highly. In the industrial sector, computer science is the most in-demand field and biomedical and bioengineering are the second and third, respectively. Engineering is widely popular. Compared to Korea, medicine, law and economics majors are few and far between. Nor are natural sciences such as math, physics, chemistry and biology in great demand.

Holders of graduate degrees represent the level of a nation's advanced human capital. In 2018, 604,368 Chinese received graduate degrees while 2,731,257 were enrolled in graduate school. This indicates that the number of students in postgraduate schools is still fast increasing. Among those 2018 postgraduates, 34.6 received advanced engineering degrees and among those

Table 1. Most Demanded College Majors & Industries in China As Of 2019

Most Demanded Majors	Industries
Computer Science (1), Electric Engineering (19)	Computer Science
Medical Engineering (5), Pharmacy (17), Nursing (2)	Bio Medical
Environment Engineering (30), Food Engineering (27), Chemistry & Pharmacy (28), Material Engineering (26)	Bio Engineering
Automation Engineering (4), Mechanical Engineering (13), Apparatus Engineering (20)	Engineering
Finance (25), Business Management (18), Economics (29)	Finance
Energy Engineering (7), Electrical Engineering (3)	Energy Engineering
Civil Engineering (22), Architecture (23)	Construction & Architecture
Transportation Engineering (8)	Transportation
Logistics Management (15)	Logistics
Journalism (21)	Mass Media

Source: Qianzhan Research Institute (bg.qianzhan.com).
Note: Ranks in terms of popularity are in parentheses.

performing their coursework, 38.5 percent were engineering majors. Including medical and hard science, the percentage of advanced degree holders in STEM fields is about 55.4 percent. About ten percent of postgraduates hold doctorates, but nearly 14.3 percent of graduate school students are enrolled in doctoral programs, which suggests that enrollment structure in post-graduate schools has improved as well.

Since 2008, the Chinese government also worked to attract and develop high-level human capital. It launched an overseas recruitment

Table 2. Number of Post Graduate Students by Field of Study in China in 2018

	Graduates		Doctor	Master	Enrollment		Doctor	Master
Philosophy	3,883	0.006	677	3,206	14,750	0.005	4,396	10,354
Economics	29,788	0.049	2,142	27,646	94,281	0.035	14,789	79,492
Law	40,740	0.067	2,933	37,807	158,694	0.058	20,121	138,573
Education	35,569	0.059	1,063	34,506	190,573	0.070	7,750	182,823
Literature	31,833	0.053	1,976	29,857	104,552	0.038	12,797	91,755
History	5,471	0.009	772	4,699	20,279	0.007	5,402	14,877
Science	54,621	0.090	12,831	41,790	226,291	0.083	73,000	153,291
Engineering	209,267	0.346	22,033	187,234	1,051,682	0.385	161,824	889,858
Agriculture	22,995	0.038	2,762	20,233	125,839	0.046	16,560	109,279
Medicine	70,708	0.117	9,699	61,009	271,406	0.099	43,162	228,244
Military Science	159	0.000	23	136	446	0.000	122	324
Administrators	79,640	0.132	3,227	76,413	395,064	0.145	26,155	368,909
Art	19,694	0.033	586	19,108	77,400	0.028	3,440	73,960
Total	604,368		60,724	543,644	2,731,257		389,518	2,341,739

Source: 2019 China Statistical Yearbook on Science and Technology, China Statistics Press.

program, the Thousand Talents Program (海外高层次人才引进暂行办法, often shortened to 千人计划), which is a recruiting program for renown scientists and top-notch engineers. The goal of this program is to recruit 1,000 of the most reputed foreign scientists and engineers such as Nobel laureates and make China a global leader in science and technology. Even though the U.S. has often criticized this program, arguing that China abuses the open U.S. system that cultivates human resources, China surpassed its goal in 2017 by recruiting more than 7,000 high end professionals.[4] In 2019, the CEO of Huawei, Ren Zheng Fei (任正非), announced a plan to recruit "geniuses," at a rate of 200 to 300 high-performing individuals per year. It recalls Samsung's recruiting program for mobilizing superior human capital.

However, there major, fundamental problem with China's human capital, which is the inefficient education ecosystem. Compared to the U.S., China's high level human capital is very homogeneous. Most high-level professionals are native Chinese. Internationally, high level workers tends to independently accumulate in the U.S. of their own accord, owing to adequate rewards, excellent colleagues and more opportunity to develop, etc. The education system is also quite different in the two countries, in that the more government-oriented college education system in China doesn't adjust well to market or industry demand. Most colleges in China are public, which means they are controlled by government, which has sole authority to restructure departments, control enrollment, etc.

5. Conclusion

This study on China's human capital carries four main implications. First, the country's population structure by age cohort is very stable, despite the anti-natal One Child policy in effect from 1980 to 2016, which means the difference in population gap between different age cohorts is not significant. It could allow for sustainable economic development. Second, the number of educated human resources in China reflects its latent potential. In the smart society of the future, people who are educated and accustomed to smart devices elevate industrial competitiveness. Third, the number people with higher education or tertiary education in China are is growing fast. The number of advanced degree holders in science and technology has increased considerably. Finally, highly educated people with masters and doctoral degrees in science and technology will play a critical role in China's future development.

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4 United State Senate (2019), "Threats to the US Research Enterprise: China's Talent Recruitment Plans", Staff Report.