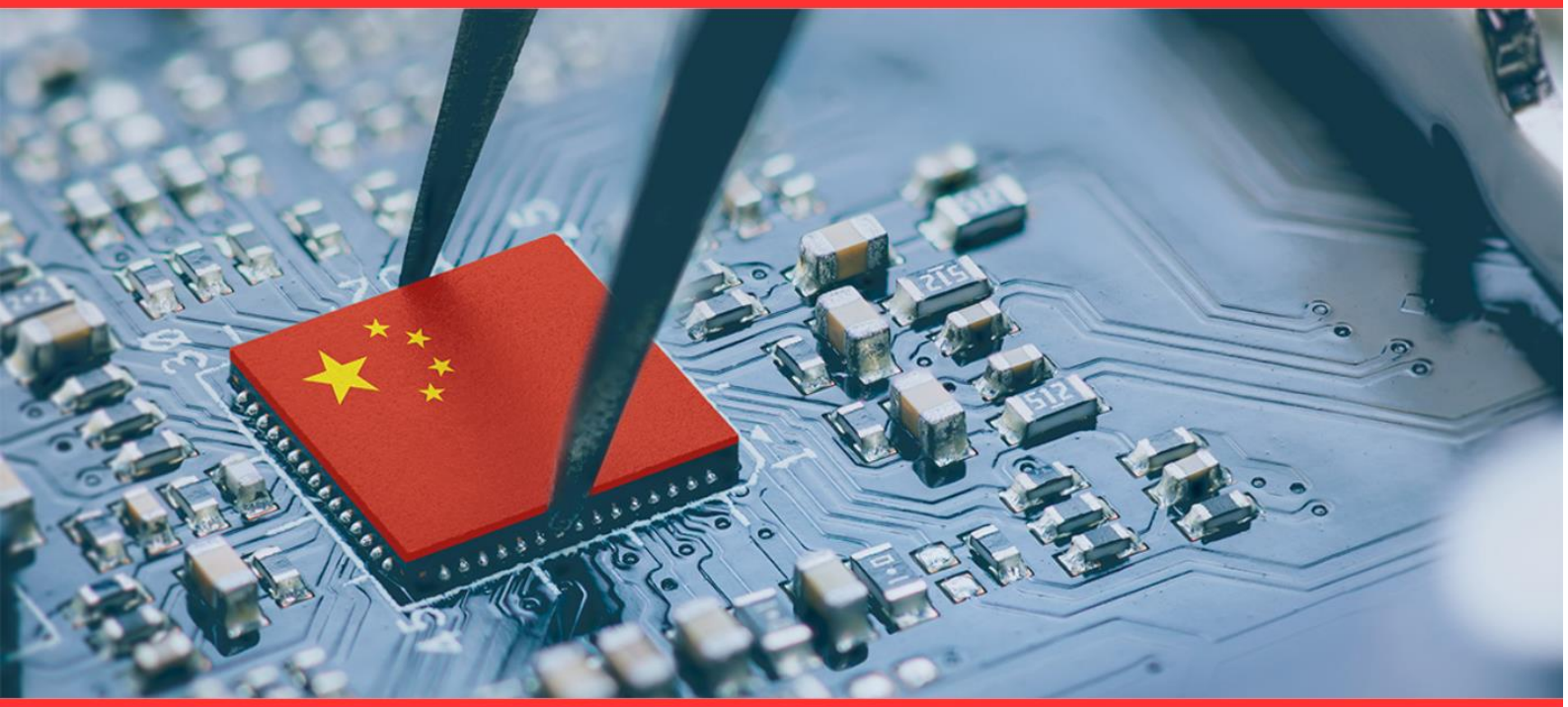
THE ROLE OF TECHNOLOGY IN CHINA'S GRAND STRATEGY: LESSONS FOR PAKISTAN



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THE ROLE OF TECHNOLOGY IN CHINA'S GRAND STRATEGY: LESSONS FOR PAKISTAN

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ABSTRACT

China’s transformation within the past few decades is truly one of the greatest achievements in human history. China has rebuilt itself from being one of the world’s poorest countries into becoming a global leader. The main driver behind China’s rapid rise has been the planning and implementation of a grand strategy by the Chinese Communist Party (CCP), and the crucial role that technology has played in this grand strategy. China opened itself up to the global economy and gradually increased its acquisition of foreign technologies. The CCP also launched various programs and strategies related to technology. Through its long-term planning, China significantly improved its science and technology related research and development (R&D) and incorporated new technologies in various industries, which positioned China into becoming a technological innovator and the potential global technology hub of the future. This paper examines the grand strategy of China and analyses the role that technology has played in it. The paper argues that China’s incorporation of various technologies across different sectors of society ultimately led to its rapid transformation. This paper also seeks to understand what lessons Pakistan can learn from China’s technological transformation.

Keywords: China, Grand Strategy, Technology, Pakistan, Fourth Industrial Revolution

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1. INTRODUCTION

China's transformation within the past few decades has been truly remarkable. Following the death of Chairman Mao Zedong, China faced a number of internal and external challenges. Since then, however, China has transformed itself economically, militarily, diplomatically, and in terms of its global influence and internal stability. Today, China is a significant challenge to US global hegemony, and is poised to overtake the US in certain metrics within the coming decades. Analysing and understanding the reasons behind China's transformation, particularly the role that technology played, is vital for all developing states. With the Fourth Industrial Revolution (4IR) well underway, the states which are able to effectively innovate and incorporate technology within critical sectors have the potential to fundamentally transform themselves and be the regional and global leaders of the future.

This paper proceeds in four sections. The first section gives a brief overview of China's transformation, particularly following the death of Chairman Mao Zedong. The second section analyses China's grand strategy, with a focus on President Xi Jinping's tenure. The third section examines the role that technology played within China's grand strategy. The final section builds on the previous sections, and explores what lessons Pakistan can learn from China's technological transformation. This paper aims to answer two central questions:

1. What was the role of technology in China's grand strategy?
2. What lessons can Pakistan learn from China's technological transformation?

To answer these research questions, this paper has employed a qualitative research methodology. Data collection involved both primary and secondary sources. These include academic books, research papers, articles, official government reports, and speeches by the Chinese leadership. Chinese, Western and Pakistani sources were all consulted to provide a balanced view.

This study is significant for a number of reasons, particularly for Pakistan. Firstly, although there has been a large amount of research conducted regarding China's grand strategy, none has focused on the role of technology within it. This represents a major literature gap, which this paper attempts to fill. Secondly, this paper is significant for the development of Pakistan. Pakistan stands at a crossroads, with 4IR already begun. If Pakistan learns from China's lesson and makes the most of 4IR, it could become a major technology player in the coming decades.

2. CHINA'S TRANSFORMATION: AN OVERVIEW

Although modern China is widely regarded as a technologically-advanced, prosperous state with a significant global influence, this was not always the case. In 1978, China's GDP per capita was just $156[1] and almost 90% of its population lived in absolute poverty[2]. Additionally, more than 80% of its citizens lived in rural areas[3]. At the time, it was by all accounts a relatively poor country. There had also been significant internal turmoil within the country, with the decade-long Cultural

[1] "GDP per capita (current US$) – China," World Bank Group, accessed September 5, 2024, https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?end=2023&locations=CN&start=1978.

[2] Dan Kopf and Tripti Lahiri, "The charts that show how Deng Xiaoping unleashed China's pent-up capitalist energy in 1978," *Quartz*, December 18, 2018, https://qz.com/1498654/the-astonishing-impact-of-chinas-1978-reforms-in-charts/.

[3] "China - Rural population (% of total population)," IndexMundi, accessed September 5, 2024, https://www.indexmundi.com/facts/china/indicator/SP.RUR.TOTL.ZS.

Revolution leading to massive societal and political instability until 1976[4]. With all of this in mind, China's rise within the past few decades becomes even more of a remarkable accomplishment.

2.1. Political Transformation

China has made tremendous political gains within the past few decades. This was largely due to its opening up to the global economy and improvement of ties with foreign powers. Gradually, it joined various global institutions including the World Trade Organisation (WTO), World Bank, and others[5]. Joining these organisations, particularly the WTO, was crucial in China's eventual modernisation in science and technology, as it gave it access to advanced scientific equipment, information technology and knowledge[6]. China used globalisation to its advantage. In 2024, its global power and influence is only growing, and it is now a direct competitor to US global influence. Under President Xi Jinping, China has a global vision through which it aims to transform the international system[7].

2.2. Economic Transformation

China's rapid economic progress has been a crucial factor behind its rise. Through economic reform and its opening up to the global economy, China's GDP rose from $218 billion in 1978 to almost $18 trillion in 2022[8]. In 2014, it surpassed the US economy in terms of purchasing power parity. Such rapid economic progress is truly a historical anomaly. Internally, China has been able to lift around 800 million

4 Tahir Hussain Andrabi, "Understanding China's Economic Miracle: Reasons and Lessons," *Strategic Studies* 34/35 (2014): 90–116, https://www.jstor.org/stable/48527477.
5 Andrabi, "Understanding China's Economic Miracle," 95.
6 Andrabi, "Understanding China's Economic Miracle," 95.
7 This has been discussed at length in Section 3.2.
8 "China's GDP, 1960-2024," Macrotrends, accessed September 6, 2024, https://www.macrotrends.net/countries/CHN/china/gdp-gross-domestic-product.

people out of poverty[9]. Externally, through its increasingly substantial economic strength, and supported by its growing influence through the Asian Infrastructure Investment Bank, BRICS, and other organisations, China has expanded its global economic influence. According to the Centre for Economic and Business Research, China is expected to surpass the US economically by 2028[10]. The Chinese Yuan could very well rival the US Dollar in the coming decades. The role of technology has been crucial in this economic transformation.

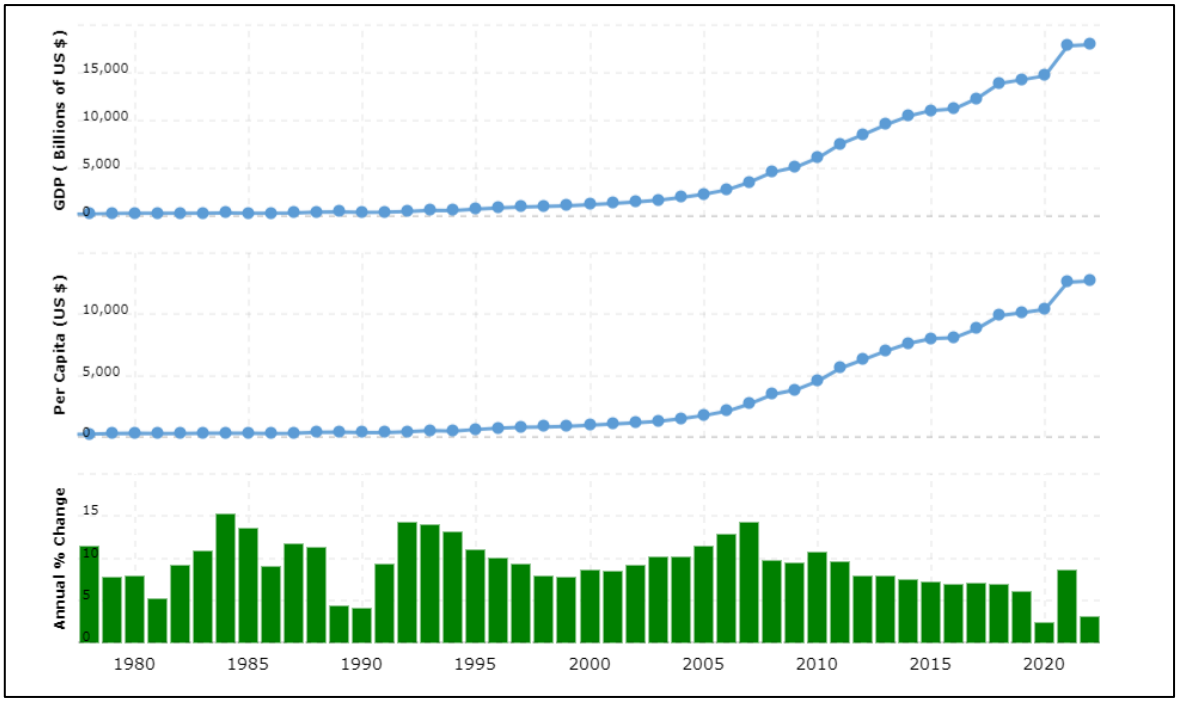

FIGURE 1: China's Economic Transformation In Terms of GDP (1978-2022)

9 "Four Decades of Poverty Reduction in China: Drivers, Insights for the World and the Way Ahead," The World Bank and the Development Research Centre of the State Council, the People's Republic of China (2022), https://thedocs.worldbank.org/en/doc/bdadc16a4f5c1c88a839c0f905cde802-0070012022/original/Poverty-Synthesis-Report-final.pdf.

10 "China set to surpass the U.S. as world's biggest economy by 2028, says report," *CNBC*, December 25, 2020, https://www.cnbc.com/2020/12/26/china-set-to-surpass-us-as-worlds-biggest-economy-by-2028-says-report.html.

2.3. Military Transformation

This economic rise has allowed for greater advancements in China's military. This, however, was a gradual process. From 1978 to 1987, the increase in China's average annual defence spending was only 3.5%, compared with its GDP growth of 14.1%[11]. It was between 1988 and 1997 that China translated its economic gains into military might, during which the average annual defence spending increased by 15.9%[12]. From then on, it has steadily increased its defence spending and has made tremendous military advancements. In 2023, China's has the second highest military budget in the world, estimated to be almost $300 billion[13]. According to a report by the US Department of Defence[14] (DOD), the People's Liberation Army (PLA) is the world's largest active-duty military force, with over 2 million active, over 1 million reserve, and over 650,000 paramilitary personnel[15]. The report also states that the People's Liberation Army Navy (PLAN) is the largest navy in the world, with nearly 400 ships and submarines[16].

Additionally, the People's Liberation Army Air Force (PLAAF), together with PLAN aircrafts, is the largest air force in the Indo-Pacific region[17]. In recent years, the PLAAF has made significant strides in enhancing its aerial capabilities. Perhaps most notable were the test flights of what many analysts consider to be sixth-

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11 Anthony H. Cordesman and Joseph Kendall, "Estimates of Chinese Military Spending," Centre for Strategic and International Studies (CSIS), 2016, https://www.jstor.org/stable/resrep23365.

12 Cordesman and Kendall, "Estimates of Chinese Military Spending," 2016.

13 Dr. Nan Tian et al. "Trends in World Military Expenditure, 2023," Stockholm International Peace Research Institute, April 2024, https://www.sipri.org/publications/2024/sipri-fact-sheets/trends-world-military-expenditure-2023.

14 The DOD's reports should certainly be taken with a grain of salt.

15 "Military and Security Developments Regarding the People's Republic of China 2023," US Department of Defence (2023), https://media.defense.gov/2023/Oct/19/2003323409/-1/-1/1/2023-MILITARY-AND-SECURITY-DEVELOPMENTS-INVOLVING-THE-PEOPLES-REPUBLIC-OF-CHINA.PDF.

16 "Military and Security Developments Regarding the People's Republic of China 2023," 2023.

17 "Military and Security Developments Regarding the People's Republic of China 2023," 2023.

generation aircrafts, which China conducted on December 26th, 2024[18]. These aircrafts, which feature cutting-edge designs and capabilities previously unseen, embody the overall military transformation that China has undergone over the past few decades. SIPRI also estimates that China possesses 500 nuclear weapons, along with advanced missile delivery systems[19]. China is steadily growing its military capabilities, and will certainly rival US military might in the coming decades.

3. CHINA'S GRAND STRATEGY

A major reason for China's rapid rise has been the planning and implementation of a grand strategy, and the role which technology has played in that grand strategy.

3.1. Defining Grand Strategy

Grand strategy can be defined as the "process by which a state relates long-term ends to means under the rubric of an overarching and enduring vision to advance the national interest."[20] In simpler terms, it can be thought of as the "alignment of potentially unlimited aspirations with necessarily limited capabilities"[21]. This alignment of means to ends must be done across time, space and scale[22].

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18 Sébastien Roblin, "Two New Chinese Sixth-Gen Fighter Jets Have Emerged in a Direct Challenge to U.S. Air Superiority," *Popular Mechanics*, January 7, 2025, https://www.popularmechanics.com/military/aviation/a63360888/china-sixth-gen-fighters/.

19 "Role of nuclear weapons grows as geopolitical relations deteriorate—new SIPRI Yearbook out now," Stockholm International Peace and Research Institute, June 17, 2024, ,https://www.sipri.org/media/press-release/2024/role-nuclear-weapons-grows-geopolitical-relations-deteriorate-new-sipri-yearbook-out-now.

20 Andrew Scobell et al. "China's Grand Strategy: Trends, Trajectories, and Long-Term Competition. Santa Monica," RAND Corporation (2020), https://www.rand.org/pubs/research_reports/RR2798.html.

21 John Lewis Gaddis, *On Grand Strategy* (Penguin Books, 2018), 21.

22 John Lewis Gaddis, *On Grand Strategy* (Penguin Books, 2018), 21.

Having a coherent grand strategy, which the entire nation is unified behind, has been crucial in China's transformation.

3.2. Chinese Grand Strategy under President Xi Jinping

Although China's grand strategy following the death of Chairman Mao focused primarily on recovery and building comprehensive national power, its grand strategy today can be defined as that of national rejuvenation[23]. Since President Xi Jinping assumed power in 2013, Chinese grand strategy has undergone a transformation, from an indirect and cautious approach to a more assertive one on the global stage.

In 2021, President Xi announced that China had achieved its goals for the centenary of the founding of CCP[24]. The goals were to make China a "moderately prosperous society." By 2049, the centenary of the founding of the People's Republic of China (PRC), the CCP aims to "build a modern socialist country that is prosperous, strong, democratic, culturally advanced and harmonious."[25] In order to achieve these goals, more detailed objectives have been set.

From 2020-2035, China aims to improve itself economically and technologically, and become a "global leader of innovation."[26] It also wants to "improve its cultural soft power and governance, achieve basic modernisation of national defence and the armed forces," among other goals[27]. From 2035-2049, China aims to become "a global leader in terms of composite national strength and

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23 Scobell et al. "China's Grand Strategy," 2020.

24 Wang Cong and Tu Lei, "Xi declares completion of moderately prosperous society," *Global Times*, July 1, 2021, https://www.globaltimes.cn/page/202107/1227540.shtml.

25 Yang Sheng, Liu Caiyu and Zhang Changyue, "New march begins – How will CPC lead China to next centenary goal?," *Global Times*, October 14, 2022, https://www.globaltimes.cn/page/202210/1277160.shtml.

26 "Full text of Xi Jinping's report at 19th CPC National Congress," *Xinhuanet*, October 18, 2017, http://www.xinhuanet.com/english/special/2017-11/03/c_136725942.htm.

27 "Transcript: President Xi Jinping's report to China's 2022 party congress," *Nikkei Asia*, October 18, 2022, https://asia.nikkei.com/Politics/China-s-party-congress/Transcript-President-Xi-Jinping-s-report-to-China-s-2022-party-congress.

international influence"[28]. It also plans to become the largest economy in the world, become the world's leading military and complete re-unification with Taiwan[29].

China's grand strategy under President Xi has also taken a much more global approach than before. It has launched several initiatives, which aim to improve China's global standing and achieve a "global community of shared future."[30] These include the Global Development Initiative, Global Security Initiative and the Global Civilisation Initiative.

Clearly, China benefited from the implementation of a grand strategy; it set its objectives, developed itself over decades, and is now reaping the rewards. The role of technology within China's overarching grand strategy, from its technological foundations under Deng Xiaoping towards 4IR under Xi Jinping, deserves to be analysed thoroughly.

4. ROLE OF TECHNOLOGY IN CHINA'S GRAND STRATEGY

"Technological innovation has become the main battleground of the global playing field, and competition for technology dominance will grow unprecedentedly fierce"

Chinese President Xi Jinping[31]

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28 "Full text of Xi Jinping's report at 19th CPC National Congress," 2017.

29 Yi Changliang, "China's Composite National Strength in 2049," The Centre for Strategic Translation, May 1, 2020, https://www.strategictranslation.org/articles/predicting-the-future-chinas-composite-national-strength-in-2049.

30 "Full Text: A Global Community of Shared Future: China's Proposals and Actions," Embassy of the People's Republic of China in Grenada, September 26, 2023, http://gd.china-embassy.gov.cn/eng/zxhd_1/202309/t20230927_11151010.htm.

31 James Kynge, "China's high-tech rise sharpens rivalry with the US," *Financial Times*, January 19, 2022, https://www.ft.com/content/aef33e33-523d-4360-981a-2daee579d9b5.

4.1. China's Technological Foundations

Before analysing the role of technology in modern China, under the leadership of President Xi, it is crucial to understand the foundation set by the CCP and various other leaders following the death of Chairman Mao.

4.1.1 Modernisation in Science and Technology

Deng Xiaoping championed the concept of the Four Modernisations, which included agriculture, industry, defence, and science and technology[32]. Although these modernisations had been announced previously by Chairman Mao, their implementation had been delayed due to the Cultural Revolution[33]. One of these modernisations was dedicated to science and technology. Deng stated that "the key to the four modernisations is the modernisation of science and technology."[34] These technological reforms aimed at a complete transformation of China's industry and economy. Clearly, the emphasis of the four modernisations was on the role of technology. This ideology served as the foundation for China's eventual transformation.

4.1.2. Open Door Policy

Deng, and other Chinese leaders, wanted to reverse the stagnation of technological progress prior to 1978. This, however, was not fully possible until China began to open up to the global economy. In terms of its technological policy related to foreign powers, China began an Open Door Policy of introducing foreign

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32 "Realise the Four Modernisations and Never Seek Hegemony, 1978, " Deng Xiaoping Archive, accessed September 18, 2024, https://www.marxists.org/reference/archive/deng-xiaoping/1978/141.htm.

33 Michael Lynch, *Teach Yourself Modern China* (Headline Publishing Group, 2006), 46.

34 "Speech At the Opening Ceremony of the National Conference On Science, 1978," Deng Xiaoping Archive, accessed September 18, 2024, https://www.marxists.org/reference/archive/deng-xiaoping/1978/30.htm.

capital and technology into its economy[35]**.** Special areas were created, including technology development zones, high-tech industry development zones and special economic zones[36]. It was through these zones that initial foreign investment and technology came into the country. Under Deng, the CCP's approach was to test new policies gradually in these zones, before applying them on a larger scale[37]. By opening up to the outside world, China sped up the process of industrialisation and modernisation[38]. Through its acquisition of foreign technology and knowledge, China was able to gradually transform its domestic technological ecosystem. Over time, exports gradually changed from resource-based products, to textile products, then mechanical and electrical products, and finally towards high-tech products[39].

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35 Shigeo Kobayashi, Jia Baobo and Junya Sano, "The "Three Reforms" in China: Progress and Outlook," Sakura Institute of Research, September 1999, https://www.jri.co.jp/english/periodical/rim/1999/RIMe199904threereforms/.

36 Ibid

37 David Daokui Li, *China's World View* (W.W. Norton & Company: 2024), 45.

38 Andrabi, "Understanding China's Economic Miracle," 96.

39 Kunwang Li and Wei Jiang, "China's 40 Years of Reform and Development: 1978–2018," Australia National University Press (2018), https://press-files.anu.edu.au/downloads/press/n4267/html/ch28.xhtml?referer=&page=40.

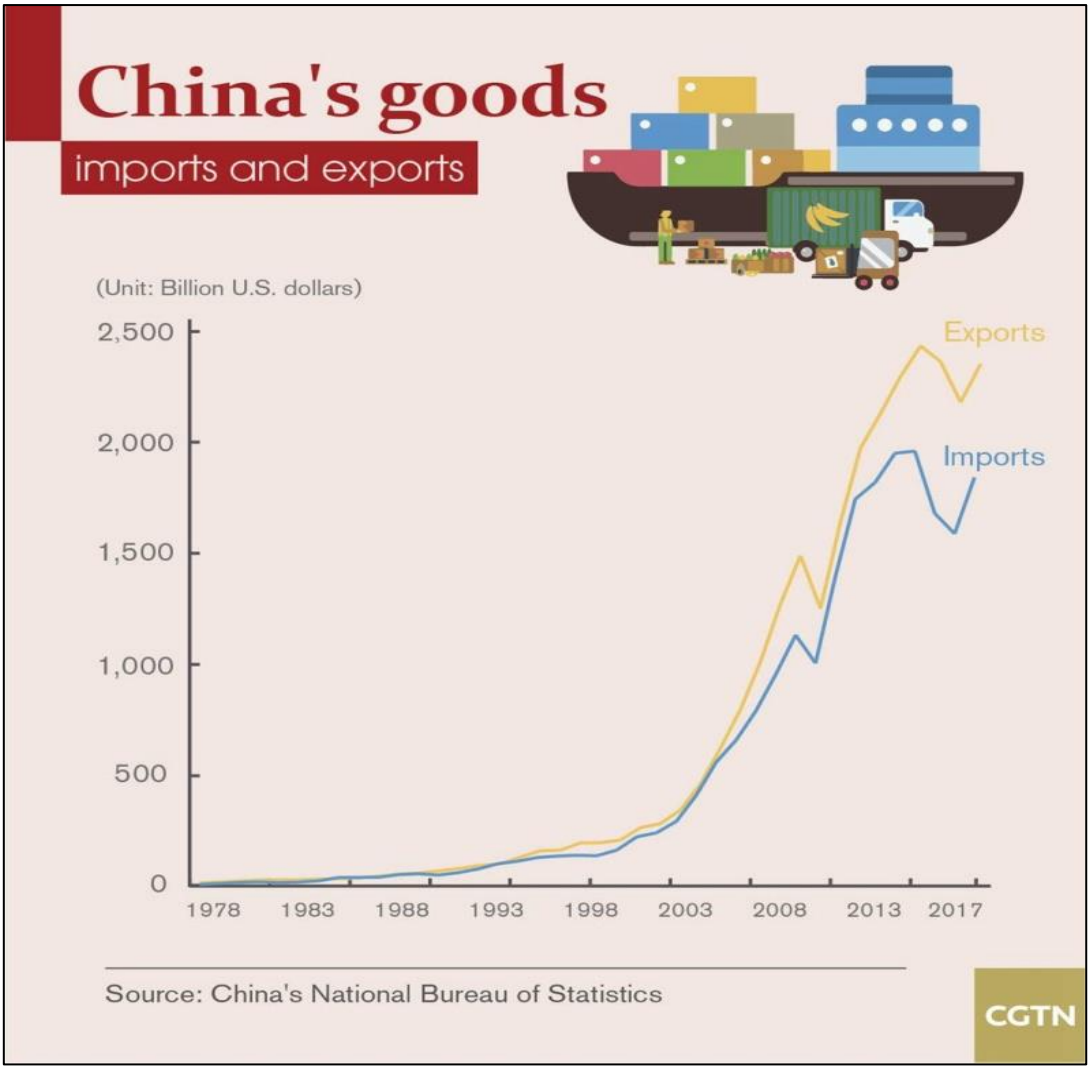

FIGURE 2: China's Import and Export of Goods (1978-2017)

4.1.3. Focus on Education

Even when it did open up, China's education sector and technology lagged behind that of other foreign powers. This was also addressed by the CCP. China began to invest heavily in its students. It sent thousands of its students abroad for higher education, with the intention of gaining knowledge of the successful Western industrial technology[40]. Emphasis was placed on scientific education and training[41]. In 2021, there were 7 times more science and engineering Bachelor's graduates

40 Lynch, *Teach Yourself Modern China*, 46.
41 Lynch, *Teach Yourself Modern China*, 46.

from China than the US, and 3 times more Doctorate graduates[42]. China began training over 1 million technical students to become the managers and administrators of the new economy[43]. Today, over 4 million new Chinese engineers graduate from colleges every year[44].

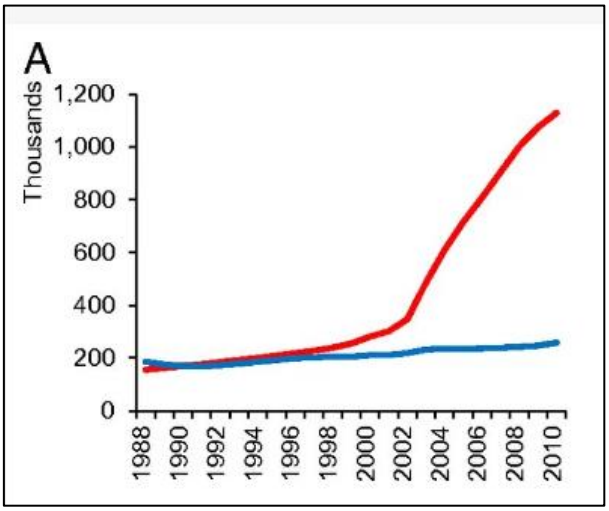

FIGURE 3: The Number of Bachelor's Degrees Awarded in China (in Red) and the United States (in Blue) from 1988-2010

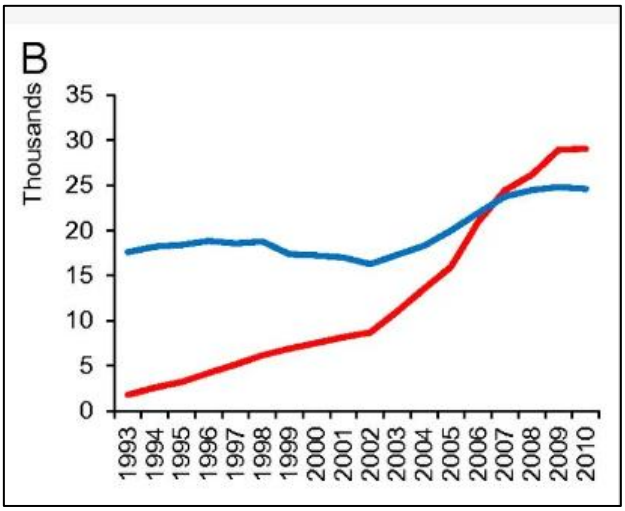

FIGURE 4: The Number of Doctorate Degrees Awarded in China (in Red) and the United States (in Blue) from 1988-2010

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42 David P. Goldman, "China marches on towards Fourth Industrial Revolution," *Asia Times*, October 8, 2021, https://asiatimes.com/2021/10/china-marches-on-towards-fourth-industrial-revolution/.

43 Lynch, *Teach Yourself Modern China*, 46.

44 Li, *China's World View*, 17.

4.1.4. Research and Development

Entrepreneurship and research were also heavily encouraged. China's research and development (R&D) steadily improved. Its annual R&D spending grew 169 times from around $2.2 billion at the start of the 1990s to over $300 billion in 2020[45]. Its patent applications went from 0 before 1985 to over 68,000 in 2020[46]. It overtook the US in terms of patent filings in 2019 and in the quantity of research papers in 2016[47].

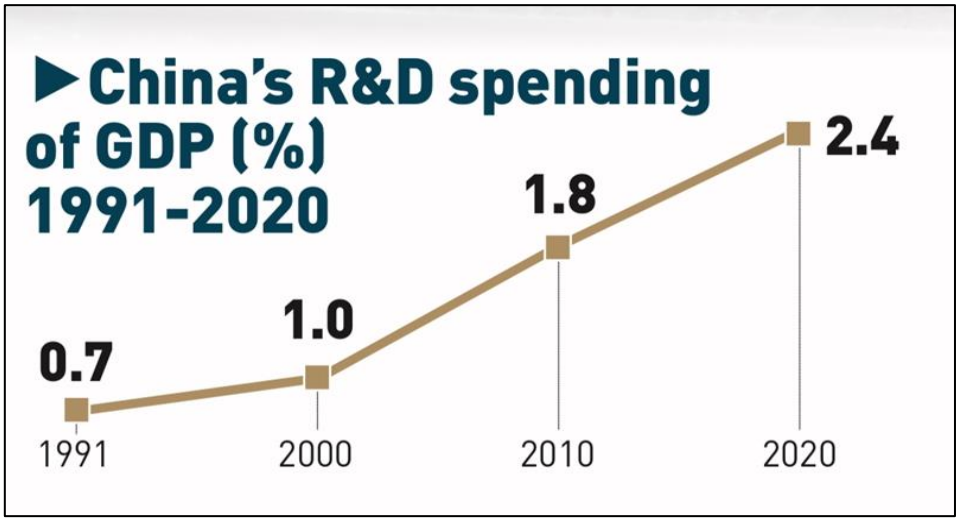

FIGURE 5: China's R&D Spending as a Percentage of GDP (1991-2020)

China's investment in education gradually began to bear fruit, and China soon began to produce a greater amount of scientific research than the US. In 2010, China had 9% more researchers than the US, having 1.2 million compared to 1.1

45 "Living in China's technological miracle," *Global Times*, July 29, 2021, https://www.globaltimes.cn/page/202107/1230033.shtml#:~:text=China's%20annual%20research%20and%20development,world's%20second%20after%20the%20US.
46 "Living in China's technological miracle," 2021.
47 "Living in China's technological miracle," 2021.

million in the US. By 2019, however, that figure had increased by 44.5%, with China boasting over 2 million researchers compared to 1.5 in the US[48].

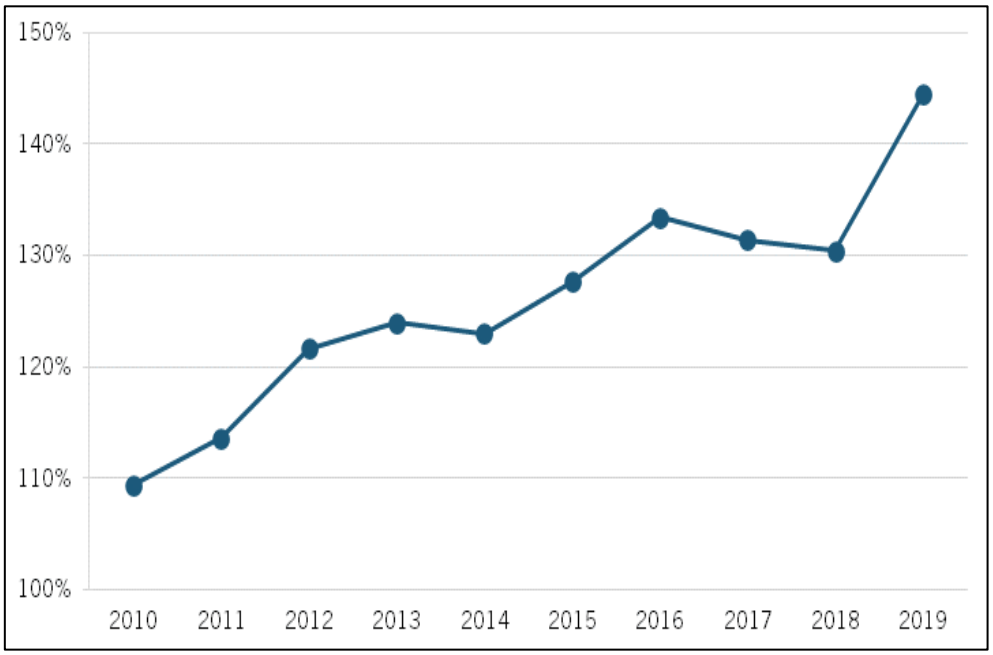

FIGURE 6: Number of researchers in China relative to the US (2010-2019)

As a result of this increase in researchers, China began to produce more research articles relating to science and technology. From 2010 to 2020, China gradually began to increase its publication rate at an annual rate of 6% compared to the US. As of 2020, China published 742,000 science and engineering articles compared to 600,000 in the US[49]. That gap has only grown wider in the years since.

[48] Ian Clay and Robert D. Atkinson, "Wake Up, America: China Is Overtaking the United States in Innovation Capacity," Information Technology and Innovation Foundation, January 23, 2023, https://itif.org/publications/2023/01/23/wake-up-america-china-is-overtaking-the-united-states-in-innovation-capacity/.

[49] Clay and Atkinson, "Wake Up, America".

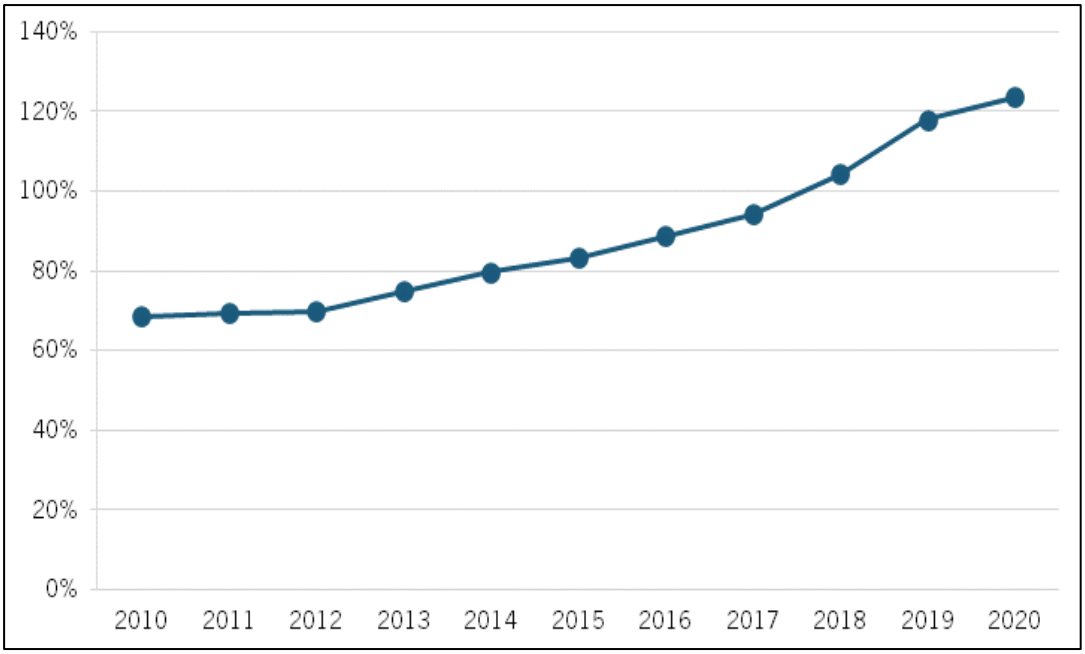

FIGURE 7: Number of science and engineering articles in China relative to the US (2010-2020)

Today, private businesses now account for more than 75% of China's economic output and 90% of non-government employment[50]. This increase in R&D, innovation and education in technology fields was primarily due to the importance given to science and technology in China's grand strategy.

4.1.5. Technology-Related Programs

"We should make advanced technologies and achievements the starting point for our development".

Deng Xiaoping[51].

The CCP had been releasing its 5-Year Plans since 1953, with the role of technology emphasised multiple times. In its 6th 5-year plan, for 1981 to 1985, some of China's main objectives were to "develop its scientific and technological base, and

50 Li, *China's World View*, 123.
51 "Speech At the Opening Ceremony of the National Conference On Science, 1978".

to promote the application of advanced technologies to meet domestic needs."[52] In its 7th 5-year plan, for 1986-1990, some of China's main objectives were to "combine domestic economic growth with external economic and technological exchanges, and increase the scale of foreign investment and advanced technologies."[53] The role of technology was specifically highlighted in every 5-year plan that the CCP has released.

There have been several other programs launched by the CCP that placed tremendous importance on technology. The primary concern for the CCP was projects related to technology, industry and commerce[54]. The 863 program, or State High-Tech Development Plan of 1986, was launched to develop advanced technologies in China in order to stop dependency on foreign technology[55]. The China National Natural Foundation was set up to distribute grant money in 1986, and a Science and Technology Leadership Small Group was established for coordination between politicians and scientists in the same year[56].

The Decision on Accelerating Science and Technology Development in 1995 aimed to "improve science and technology research within the next few decades, and to incorporate new technologies into various industries."[57] The National Medium and Long-Term Plan for the Development of Science and Technology (2006-2020) was also launched in 2006, which aimed to turn China into an "innovation-oriented

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52 "The 6th Five-Year Plan (1981-1985)," The China Internet Information Centre, accessed September 13, 2024, *http://www.china.org.cn/english/MATERIAL/157619.htm.*

53 "The 7th Five Year Plan (1986-1990)," The China Internet Information Centre, accessed September 13, 2024, http://www.china.org.cn/english/MATERIAL/157620.htm.

54 Lynch, *Teach Yourself Modern China*, 46.

55 Yu Xie, Chunni Zhang and Qing Lai, "China's rise as a major contributor to science and technology," Proceedings of the National Academy of Sciences 111, no. 26 (2014): 9437-9442, https://doi.org/10.1073/pnas.1407709111.

56 Barry Naughton, *The Rise of China's Industrial Policy, 1978-2020* (Lynne Reinner Publishers, 2021), Chapter 1, https://www.rienner.com/uploads/6061eb686a892.pdf.

57 "PRC State Council on Decision on Accelerating S&T Development", Federation of American Scientists, accessed September 13, 2024, https://nuke.fas.org/guide/china/doctrine/stdec2.htm.

country and the world's leading scientific power."[58] The intention of the CCP through launching and effectively implementing these programs is clear; they saw technology as a way to transform China, and wanted to make it the foundation for their eventual reform.

4.1.6. The World's Manufacturing Hub

Through the planning and implementation of its grand strategy, and the role of technology in it, China was able to transform itself in every sense. It became the manufacturing hub of the world, by turning to investment, industrial development and productivity growth. There were several factors which supported China's transformation, including the country's cheap workforce. Other states began moving the significant portions of their production chains to China, which gradually gave it manufacturing prowess and made it central to global supply chains[59]. A lot of credit has to be given to Deng Xiaoping, who made significant changes to the country's domestic and global outlook. Deng also revived the ancient Chinese concept of "Xiaokang"[60], or a moderately prosperous society, which the CCP has built on and placed great importance on[61].

4.2. Towards the Fourth Industrial Revolution

Today, 4IR is already underway. States which gain an edge in innovation regarding emerging technologies could go on to become the major technological

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58 Yutao Sun and Cong Cao, "Planning for science: China's "grand experiment" and global implications," Humanities and Social Sciences Communications 8, 215 (2021), https://doi.org/10.1057/s41599-021-00895-7.

59 Rush Doshi, "The United States, China and the contest for the Fourth Industrial Revolution," Brookings Institute, July 31, 2020, https://www.brookings.edu/testimonies/the-united-states-china-and-the-contest-for-the-fourth-industrial-revolution/#footnote-9.

60 Yu Shaoxiang, "Firm commitment guarantees China victorious with 'xiaokang' as West stagnates," *Global Times*, July 1, 2021, https://www.globaltimes.cn/page/202107/1227545.shtml

61 Zhang Airu, "From "moderately prosperous" to "comprehensively prosperous"——On the formation and development of Deng Xiaoping's theory of a well-off society," *People's Daily*, July 14, 2014, http://cpc.people.com.cn/n/2014/0714/c69113-25279758.html.

states of the future. China is currently leading the way, along with the US, when it comes to various emerging technologies, such as AI, robotics, cyberspace technologies, bio-technologies and many others. The major reason for China taking the lead has been the role of technology in its grand strategy.

Speaking at the BRICS Business Forum in 2018, President Xi Jinping said that "the next 10 years will be the key 10 years for the transformation of the old and new kinetic energy of the world economy…we must seize this major opportunity to promote the leapfrog development of emerging market countries and developing countries."[62] It is clear the importance given to technology by China; they have tied it with the future of the world order, and aim to be at the centre of it. China's 2049 Plan states its aim to become a "global leader of innovation"[63]. To meet its 2049 targets, China has launched various programs within the last decade.

4.2.1. 14th 5-Year Plan

In China's 14th 5-year plan, for 2021-2025, it aims to make significant advancements in emerging technologies, increase R&D spending by 7% every year over the next 5 years and attain technological autonomy for critical technological components[64]. In the plan, China identified several emerging technologies it intended to focus on, including Artificial Intelligence (AI), semiconductors, quantum technology, biotechnology, and space technology[65].

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62 "Xi Jinping: Follow the trend of the times and achieve common development," *People's Daily*, July 26, 2018, http://cpc.people.com.cn/n1/2018/0726/c64094-30170246.html.

63 Changliang, "China's Composite National Strength in 2049".

64 "China ramps up tech commitment in 5-year plan, eyes 7% boost in R&D spending," *Reuters*, March 5, 2021, https://www.reuters.com/article/us-china-parliament-technology-idUSKBN2AX055.

65 "China ramps up tech commitment in 5-year plan," 2021.

4.2.2. Made in China 2025

"In order to raise China's scientific and technological level we must rely on our own efforts, develop our own creativity and persist in the policy of independence and self-reliance".

Deng Xiaoping[66].

China's Made in China 2025 plan, announced in 2015, aims to make it a leading state in technology, by further developing its manufacturing sector and decreasing dependency on foreign technology imports[67]. Through the plan, China wants to "raise the domestic content of core components and materials in high-tech manufacturing to 70% by 2025."[68] The plan identifies 10 key industries, including semiconductors, information technology, robotics and aerospace equipment[69]. Other key technological domains are highlighted in which China has already made significant progress in terms of indigenous development, such as electric vehicles, nuclear power, quantum computing, 5G and more[70].

4.2.3. Next Generation Artificial Intelligence Development Plan

China is ramping up its AI investment, research and development on a historic scale[71]. In 2017, China released the Next Generation Artificial Intelligence Development Plan (NGAI), in which it announced its strategy to become the "world

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66 "Speech At the Opening Ceremony of the National Conference On Science, 1978".

67 "Made in China 2025," Centre for Security and Emerging Technology, accessed September 18, 2024, https://cset.georgetown.edu/wp-content/uploads/t0432_made_in_china_2025_EN.pdf.

68 James L. Schoff and Asei Ito, "Competing with China on Technology and Innovation," Carnegie Endowment, October 10, 2019, https://carnegieendowment.org/2019/10/10/competing-with-china-on-technology-and-innovation-pub-80010.

69 "Made in China 2025," 2024.

70 "Made in China 2025," 2024.

71 Kai-Fu Lee, *AI Superpowers: China, Silicon Valley, and the New World Order* (Houghton Mifflin Harcourt, 2018), 3.

leader in AI by 2030". China wants to build a $150 billion industry, and also intends to be the leading force in establishing global AI ethics and norms.[72] China considers AI to be a strategic technology[73]. By 2030, AI is estimated to add around $16 trillion to the global GDP, of which China would take home $7 trillion[74]. AI is a tremendous opportunity for China, as its effective application might allow it to surpass the US[75]. As of 2024, China is poised to catch up with the US in AI because of its engineers, computing power and data[76].

Through these various technology-related programs, we can understand the current grand strategy of China. It aims to achieve national rejuvenation through the innovation and incorporation of various new technologies. Currently, it is on course to become the global technology hub of the world and, as a result, potentially surpass the US to become the global leader of the future.

4.2.4. Belt and Road Initiative

China's Belt and Road Initiative (BRI), which was launched in 2013, is perhaps the greatest manifestation of its grand strategy[77]. The BRI aims to make China central to the global economy through various infrastructure development projects. However, it also gives great importance to technology. China aims to use its technological advancements of the past few decades to build transport and infrastructure projects in more than 70 countries. These projects simply cannot exist without Chinese technology, including both software and hardware[78]. The project

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72 Huw Roberts *et al.* "The Chinese approach to artificial intelligence: an analysis of policy, ethics and regulation," *AI & Soc* 36, 59-77 (2021), https://doi.org/10.1007/s00146-020-00992-2.

73 Roberts et al. "The Chinese approach to artificial intelligence," 2021.

74 Lee, *AI Superpowers,* 18.

75 Lee, *AI Superpowers,* 6.

76 Li, *China's World View*, 17.

77 Simon Curtis and Ian Klaus, *The Belt and Road City* (Yale University Press, 2024), 36.

78 "BRI: Digital know-how along China's BRI will set future global tech standards," *Zawya*, January 2, 2022,

also entails technology transfers between China and BRI countries with technology including agriculture, energy, transportation, information and communication, medical health and others[79]. A major aspect of BRI is the Digital Silk Roads, through which China aims to export its Internet and 5G to states around the world[80]. Through BRI, China aims to build a new kind of international order through which it can project Chinese power[81], all while becoming a global technology hub.

5. LESSONS FOR PAKISTAN

There are various lessons that Pakistan can learn from China's transformation, and the role that technology has played in its grand strategy. It is important to mention, however, that the reasons for China's rapid transformation cannot directly be applied to Pakistan. The political system of China allows for top-down technological innovation and incorporation[82], whereas Pakistan has not seen political stability for a long-time. However, the lessons from China's technological transformation should certainly be adapted by Pakistan in a way which reflects the context of the country.

5.1. Long-Term Planning and Effective Implementation

Perhaps the foremost lesson that Pakistan can learn from China is the implementation of a grand strategy. In order for Pakistan to plan and implement its grand strategy, it must first ensure that there is political stability at home, as the CCP did, and that successive governments cooperate rather than compete with each

https://www.zawya.com/en/business/bri-digital-know-how-along-chinas-bri-will-set-future-global-tech-standards-oj9bn5hc.

79 Mae Thiwari, "BRI as a Win-Win Economic Engine," Asian Institute of Technology, July 1, 2021, https://www.ait.ac.th/2021/07/bri-as-win-win-regional-economic-engine/.

80 Curtis and Klaus, *The Belt and Road City,* 71.

81 Curtis and Klaus, *The Belt and Road City,* 1.

82 Doshi, "The United States, China and the contest for the Fourth Industrial Revolution".

other. Pakistan must learn from China, and prioritise what is absolutely essential in the short-term, and then gradually work towards its long-term goals. This of course, as was the case with China, will take decades to implement. Ultimately, states should simply not seek ends beyond their means[83]. The same applies for Pakistan.

A potential case study which Pakistan could refer to is that of South Korea, a country which focused on long-term planning and implementation. From 1962-1996, South Korea announced and successfully implemented seven consecutive economic development plans[84]. Through its long-term planning, South Korea gradually transformed itself from a relatively low-income state to a technology-driven and economically stable one. As a result of its long-term planning and implementation, South Korea's GDP per capita went from only $103 in 1962 to $33,000 by 2023[85]. Interestingly, Pakistan's GDP per capita was $89 in 1962, and has increased to only $1,407 as of 2023[86].

5.2. Technology as Foundation for Progress

Within its long-term objectives, Pakistan must place emphasis on the role of technology, particularly emerging technologies such as AI, cyberspace and space technologies, among others. 4IR is already underway, and in this new phase of technological revolution, technology simply cannot take a back seat. Pakistan has done well to invest in AI and emerging technologies. It must learn from China's example and make technology the base of its transformation. With its geopolitical

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83 Gaddis, *On Grand Strategy*, 21.

84 Michael J. Seth, "South Korea's Economic Development, 1948–1996," Oxford Research Encyclopedia of Asian History, December 19, 2017, https://doi.org/10.1093/acrefore/9780190277727.013.271.

85 "South Korea GDP Per Capita 1960-2025," macrotrends, accessed March 18, 2025, https://www.macrotrends.net/global-metrics/countries/KOR/north-korea/gdp-per-capita?utm_source.

86 "Pakistan GDP Per Capita 1960-2025," macrotrends, accessed March 18, 2025, https://www.macrotrends.net/global-metrics/countries/PAK/pakistan/gdp-per-capita.

importance, Pakistan has the potential to become a major technology player in the region.

A relevant case study for Pakistan could be that of Estonia, which has recently begun the process of transforming itself into a completely digital society, by placing technology at the heart of its development. Estonia is now the world's most digitised country, boasting 100% of its state services being online, 6.6% of its citizens working in the ICT sector, and over 1600 startups[87]. Due to these advancements, Estonia's GDP per capita went from $3,000 in 1995 to $30,000 in 2023[88].

5.3. Indigenous Development of Technology

Although Pakistan should definitely cooperate with its allies such as China, ultimately there is no substitute to indigenous development of technology. This is the exact same ideology that China followed. China focused on the indigenous development of technology, waited, and is now one of the most technologically advanced states in the world. Pakistan should follow a similar path. It must create a vibrant technology ecosystem, and translate the results to various sectors in order to achieve its economy, military and political objectives.

Türkiye is another country which focused on the indigenous development of technology. In both the civilian and military domains, Türkiye has built a robust domestic technology ecosystem. In the 1990s, Türkiye was still reliant on foreign powers for its technology. Gradually, however, that changed. Advancements in

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87 "Facts and Figures," e-Estonia, accessed March 18, 2025, https://e-estonia.com/facts-and-figures/.

88 "GDP per capita (current US$) - Estonia," World Bank Group, accessed March 18, 2025, https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=EE&view=chart&utm_source.

automotive, IT, consumer electronics, telecommunications and aerospace industries have established Türkiye as a technological powerhouse[89].

5.4. Incentivise Research and Development

China's focus on R&D played a major role in its technological transformation. Pakistan must follow the same example. R&D is the bedrock of scientific and technological progress. Pakistan should focus on science and technology related R&D. It needs to incentivise its researchers to stay in Pakistan and stop the current brain drain. Singapore is another country which Pakistan can take as a case study to incentivise R&D. As of 2020, Singapore spent over 2.1% of its GDP on R&D[90]. In contrast, Pakistan spent only 0.16% of its GDP on R&D[91]. Through investment, and incentivising its researchers to stay in the country, Singapore was able to transform itself into a global leader in tech innovation.

5.5. Focus on Science and Technology-Related Education

China also focused on education, and encouraged its students to go abroad for higher education. Pakistan must follow the same example. Students must be facilitated to go abroad for studies, and then incentivised to return home and contribute to the country's growth. University-level education should also be tailored towards the market. When a student finishes their Bachelor's education, they should be well-equipped to enter the workforce. University students should be taught in such a manner as to build their expertise in critical sectors, particularly in the fields of science and technology. Finland is a great case study for Pakistan in terms of

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89 Ravale Mohydin, "Historical Milestones in Türkiye's Tech Evolution," *TRT World*, August 26, 2024, https://researchcentre.trtworld.com/wp-content/uploads/2024/08/Historical-Milestones-in-Turkiyes-Tech-Evolution.pdf.

90 "Research and development expenditure (% of GDP) – Singapore," World Bank Group, accessed March 18, 2025, https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=sg&most_recent_year_desc=true&utm_source.

91 "Research and development expenditure (% of GDP) – Pakistan," World Bank Group, accessed March 18, 2025, https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=PK.

education. In 2022, Finland spent 5.5% of its GDP on education[92], compared to only 1.9% by Pakistan in 2023[93]. From the 1990s onwards, Finland has gradually increased its focus on science and technology related education, and has seen significant results.

5.6. Empower Private Industry

As China did, Pakistan must empower its industry and follow a public-private partnership model. Particularly in 4IR, technological progress cannot be led by the government. Rather, it should be led by the private industry and empowered by the government. This is the model followed not only by China, but essentially every other major state in the world. By incentivising companies to operate in Pakistan, it will lift up the country. As China did, Pakistan must empower innovation and entrepreneurship. This is the one factor which all the countries mentioned have in common. Whether it is China, Türkiye, South Korea, Singapore, Estonia, Finland or others that have made progress, the private sector has been at the heart of it. These case studies serve as proven examples for Pakistan to follow.

6. CONCLUSION

China's rapid rise over the past five decades is truly a remarkable achievement. Crucial to this rise has been the planning and implementation of a grand strategy by China, and the role of technology in that grand strategy. From 1978 onwards, the CCP has made a concerted effort to improve the level of science and technology R&D, education, innovation and incorporation into various sectors of

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92 "Government expenditure on education as a percentage of GDP in Finland in selected years from 1990 to 2022," statista, accessed March 18, 2025, https://www.statista.com/statistics/530295/finland-share-of-public-expenditure-on-education-in-the-gdp/.

93 "Government expenditure on education, total (% of GDP) - Pakistan", World Bank Group, accessed March 18, 2025, https://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS?locations=PK.

Chinese society. China's opening up to the global economy also allowed foreign technology to flow into the country. Gradually, it made use of this new technology and completely transformed itself. The Chinese population went from farmers under Mao Zedong, to factory workers under Deng Xiaoping and now engineers under Xi Jinping. China's grand strategy includes several long-term objectives for 2049, many of which include technology. With further advancements in technology, China could very well become the technology hub of the world and, as a result, surpass the US to become the next global leader.

Pakistan also stands at a crucial point in its history. With 4IR well underway, Pakistan has the chance to improve itself technologically and, as a result, economically, politically and militarily as well. Revolutionary technologies and domains such as AI, space, cyberspace and others provide Pakistan with opportunities to become a major regional and global technology player. This all depends on whether Pakistan is able to learn lessons from China, and not repeat the same mistakes of its past.

Going forward, Pakistan must follow a multi-pronged approach, through which it can be best prepared for 4IR. Firstly, Pakistan must shift its focus away from short-term planning towards long-term planning and implementation. Building on this foundation, Pakistan must introduce and successfully carry out policies that empower its domestic industry, increase its focus on science and technology-related education and R&D, and ultimately move towards the indigenous development of technology. Pakistan should seek to emulate China, in order to achieve its true potential.

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