

Defining China's Smart Power in Science and Technology

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Abstract. This research focuses on the embodiment of smart power in China's science and technology development. This paper first introduces the definitions of soft power, hard power and smart power. Furthermore, it compares the current status and development of China's soft power, hard power and smart power, and identifies China's problems in terms of access to modern technology, intellectual property protection, as well as regulatory and ethical issues. Moreover, this research explores possible ways to improve China's smart power of science and technology. Finally, the study finds that China's smart power developments in science and technology can be used as both diplomatic and economic tools, reshaping international technology policy and establishing new global norms.

Keywords: China, smart power, technology, science

1. Introduction

Nye defined soft power as the ability to sway people's decisions without resorting to coercion or threats of violence; it can be seen as a function of the attractiveness of a country's foreign policy, political values, and culture [1]. Conversely, hard power refers to the application of coercion or force to achieve objectives and influence others [1]; hard power can include using force, imposing financial penalties, or using other coercive measures. Nye makes the case that, in order to conduct foreign policy effectively, coercive and persuasive tactics must be combined, with the use of hard and soft power depending on the circumstances [2]. As a result, he created the term 'smart power', which refers to the skilful use of a delicate balance between hard and soft power to accomplish goals related to policy and successfully address difficult global issues.

This research is mainly about the China's smart power in science and technology. The advancement of civilisation and human history have been largely dependent on the development of science and technology. The steam, electrical, and information eras are the three main industrial revolutions that have affected human civilisation to date and were made possible by science and technology. Moreover, every revolution has had a profound effect on world politics [3]. The world's attention switched to the United States during the second and third revolutions, whereas Britain remained at the centre of power during the first revolution. China and other developing economies are currently playing more significant roles in the technological and economic spheres throughout the ongoing Fourth Industrial Revolution [4].

In particular, China has emerged as a technical powerhouse, mostly due to its rapid developments in artificial intelligence, renewable energy, and 5G technology. These advancements indicate a shift in the global economic and technological centre of gravity towards the East [5]. This change is a manifestation of China's increasing use of smart power, which blends hard power (by imposing control over economies and technologies) with soft power (by influencing international standards, collaboration, and innovation in these areas).

Through its smart power initiatives, China appears to be solidifying its technological lead and raising its visibility internationally. Considering this, the main goal of this article is to define China's smart power through the use of scientific and technological developments.

2. Comprehending Soft Power

2.1. Definition of Soft Power

The ability of a nation or organisation to sway people by attraction and persuasion without using force or coercion is known as soft power [6]. It is the ability to persuade people to support a position without resorting to violence. In order to accomplish this

goal, soft power emphasises appeal and persuasion more than force or financial pressure [2]. To increase its influence abroad, soft power depends on the favourable effects of culture, values, policies, and the state's reputation worldwide. States can improve their international standing and strengthen their influence in world affairs in a number of ways, for instance, by actively participating in international collaboration, offering foreign help, and promoting cultural items.

Nye identifies three primary factors that determine soft power [6]. The first factor is political values: nations that uphold democratic ideals, human rights, and the rule of law can form alliances with other like-minded states. Another factor is culture, which can be attractive to other nations in many ways. Finally, forming alliances, engaging in international cooperation, and utilising diplomacy are ways in which a country might bolster its soft power [7].

2.2. Soft Power of China

According to Brand Finance, China has improved its score the most, moving up to third place in the worldwide soft power ranking [8]. There are three main components to China's enhanced soft power, according to the most current data from a report by Brand Finance. Firstly, because China is one of the oldest civilisations in the world, it has a rich heritage of traditional cultural treasures; numerous aspects of China's culture have contributed to its rise in soft power internationally, increasing the number of nations eager to learn more about China. Confucianism, conventional Chinese medicine, Confucius Institutes dispersed across several countries, and ancient Chinese literature are a few instances of these resources [9].

However, China has several obstacles to soft power in the area of political ideals [10]. The global perception of China is influenced by a number of factors, including authoritarianism, the Communist Party's control over the legal system, its power concentration, and stringent control over the media and its ideology. These reasons lead to a gap between China's soft power investment and its outcomes [11].

Finally, and perhaps most importantly, China has actively strengthened its diplomatic connections with other countries by supporting initiatives like the Shanghai Cooperation Organization and the Belt and Road Initiative, which raise China's profile internationally and give it greater soft power [12].

3. Comprehending Hard Power

3.1. Definition of Hard Power

As noted earlier, hard power is the capacity to achieve goals by using economic or military strength, or by threatening others with the use of economic or coercive power [1]. This power focuses on physical resources and capabilities, including weaponry, military, economic assets, and technology, focused on influencing others or obtaining goals through deterrence, coercion, or economic pressure [13].

According to Ratha, the primary differentiation between hard and soft power is in the former's emphasis on attraction and persuasion, while the latter is more concerned with coercive tactics such as military action and economic sanctions [14]. In many cases, hard power is easier to experience than soft power, and it can be somewhat less expensive to put into practice, not in terms of money, but in terms of knowing how to utilise it well. It is real, more easily to feel and appears in obvious, practical ways, making its consequences more visible and measurable [15].

3.2. Hard Power of China

China's hard power is mostly evident in its economic, military, and scientific and technological capabilities; nevertheless, these domains are accompanied by a multitude of obstacles and issues.

China is a major player in global commerce and markets, given its status as the second-biggest economy in the world [16]. Infrastructure projects, such as the Belt and Road Initiative, boost global connectivity and trade. However, China's economic progress has recently been hindered by pressure to reform, particularly in the industrial and real estate sectors [16]. Among the many economic difficulties China has huge amounts of debt held by businesses and local governments, which pose financial hazards [17]. Trade disputes with other countries, particularly the United States, have also had a significant influence on China's exports and supply chains [18].

Secondly, in the military arena, Global Firepower's assessment of the world's top ten countries in terms of military power in 2024 places China as having the third greatest military [19]. However, China's military development and disputes over maritime rights, notably in the South China Sea, have led to tensions with neighbouring countries and regional powers [20]. Furthermore, there are worries about regional and global security because China's military development might start an arms race with other superpowers. Lastly, because of China's expanding military power, the world is now increasingly concerned with the nation's military goals and lack of transparency [21].

Finally, high-tech companies like Huawei, Alibaba, and Tencent are important players in global technology and e-commerce, particularly in science and technology [22]. China is also subject to technological blockades and limitations from other nations, such as the penalties imposed on Huawei. Moreover, China is dealing with issues related to data security and privacy protection

as a result of technological advancements [23]. International collaboration barriers would restrict China's technological advancement and market access in several delicate fields, such as artificial intelligence and 5G technology [24].

4. Developing the Idea of Smart Power

4.1. Definition of Smart Power

By integrating the hard power of bribery and coercion with the soft power of attraction and persuasion, Nye defines smart power as the capacity to use environmental intelligence to choose techniques that are effective [2]. He contends that a combination of soft and hard power is necessary for effective national strategy and foreign policy. Instead of just depending on one tactic, smart power employs a blend of attraction and coercion that is tailored to specific goals and conditions [25]. This approach entails being flexible and determining the ideal ratio between these two types of power to deal with diverse global issues. To put it simply, smart power is the ability to recognise when and how to employ force and persuasion successfully in international affairs, as well as the use of a nuanced strategy to achieve goals [26].

4.2. Examples of Smart Power Worldwide

The first instance of smart power can be seen with the United States dealing with growing instability and bloodshed in Iraq in 2007. A combination military-reconstruction and stabilisation approach was needed to address the issue. The US used physical force by sending more soldiers to bolster security and quell insurgency. Costantini stated that the goal of this military buildup was to use hard force to pacify areas and lessen bloodshed [27]. In terms of its soft power, the US has contributed to economic growth, political reconciliation, and reconstruction projects. In order to enhance living circumstances and win support from the community, this involved restoring infrastructure, assisting with local government, and delivering humanitarian supplies [28].

Another example of smart power is China's grandiose global development plan, the Belt and Road Initiative (BRI). This plan was introduced in 2013 with the goal of promoting economic growth and commerce across Asia and beyond [29]. China used its hard power to spend billions of dollars on ports, roadways, and trains across several nations, with the aim of establishing solid commercial ties and securing strategic resources. In addition, China encouraged people-to-people contacts, educational initiatives, and cultural exchanges as forms of soft power. Furthermore, the founding of Confucius Institutes was a part of this process, serving to advance diplomatic relations and disseminate Chinese culture [30].

A final example of smart power is the European Union's 2009 introduction of the Eastern Partnership Initiative, aiming to deepen relations with six Eastern European nations: Armenia, Azerbaijan, Belarus, Georgia, Moldova, and Ukraine. From the standpoint of hard power, the EU used economic and political pressure to encourage democratic changes and bring policies into compliance with its norms. This included conditional economic deals and political engagement [31]. Eastern European nations were encouraged to apply for membership in the EU due to its appeal from a soft power perspective. In order to promote democratic governance, human rights, and economic growth in these countries, the EU has made significant financial aid, technical assistance, and capacity-building initiatives available [32].

These case studies highlight the usefulness of smart power in addressing challenging international challenges by showing how political entities mix hard and soft power to achieve strategic objectives.

5. China's Scientific and Technological Progress

5.1. Principal Areas

At least four areas can demonstrate China's advancements in science and technology: artificial intelligence, 5G technology, renewable energy, and space exploration. China has achieved great strides in AI research and applications, particularly in the areas of computer vision, natural language processing, and machine learning [33]. Technology companies in China, including Baidu, Alibaba, and Tencent, have made significant investments in AI technology research and development. These companies boast the top AI research teams in the world. The applications of AI technology are diverse and include financial technology, healthcare, automated driving, and the creation of intelligent cities. Notably, China's AI face recognition technology is among the best in the world [34].

Additionally, China is one of the first nations to deploy 5G networks, offering rapid developments in commercial applications together with extensive coverage [35]. Leading Chinese telecommunications firms, including ZTE and Huawei, are fiercely competitive in the development and manufacturing of 5G equipment [36]. In terms of data transmission speed, latency, and connection density, China's 5G technology has surpassed that of other countries [37].

Furthermore, China is the largest producer and consumer of solar photovoltaic technology in the renewable energy space, with the largest cumulative solar power production capacity. Additionally, it is the global leader in wind power generation, with remarkable talents in the research, development, and manufacturing of wind power technology [38].

China boasts an advanced ‘Long March’ carrier rocket, the Chang’e and Tianwen probes to explore the moon and Mars, an autonomous aerospace science and technology system, and the Tiangong space station, which has completed the launch and assembly of multiple modules [39].

5.2. China’s Smart Power in Science and Technology

One may encapsulate China’s smart power in science and technology into three primary categories. Firstly, the nation has increased its R&D spending dramatically. Currently, the government spends over \$500 billion per year on fields like artificial intelligence, biotechnology, and renewable energy [40]. The ‘Made in China 2025’ strategy and the 14th Five-Year strategy are two significant initiatives that aim to foster technical innovation and leadership. This investment is supported by strong government regulations, active participation from the business sector, and growing international alliances [41].

Another way soft and hard power are integrated with technology can be seen in how China maintains extensive and diverse international connections and partnerships in the field of smart power and technology. These connections focus on several key areas, including but not limited to: 1) China working with international partners on renewable energy technologies, including wind, solar, and hydropower. Typical examples of these collaborations are joint ventures and technology exchanges with companies and institutions in Asia, the United States, and Europe. 2) Its interactions with the US, Germany, and South Korea in the electric car industry. China places a high priority on developments in vehicle design, charging infrastructure, and battery technology. 3) Chinese firms working with foreign partners to develop 5G and artificial intelligence (AI) technologies, for example ZTE and Huawei. These agreements often entail cooperation research and infrastructural endeavours, notwithstanding some geopolitical considerations.

Last but not least, in terms of technological exports and influence, consumer electronics, telecommunications equipment, semiconductors, and componentry are among China’s top technology exports [42]. Brands like Vivo, Oppo, and Xiaomi have significantly increased their share of the worldwide market. Xiaomi ranked third in 2024 with 14.8% share while Vivo and OPPO tied for the fourth place with shares of 9.1% and 9.0% share respectively. Xiaomi and Vivo both saw double-digit growth with strong performances in emerging markets and China [43]. Moreover, important suppliers of 5G technology and other telecommunications infrastructure are Chinese companies like ZTE and Huawei. China is also a significant exporter of different semiconductor components, even if the country is still growing in terms of its capacity to produce high-end chips.

5.3. Implications for Global Influence

China’s meteoric ascent to prominence in the technology industry has had a significant effect on the global economy. Firstly, by establishing industry standards that are mostly dominated by Chinese technology goods, China has proven its leadership in a variety of technology-related sectors. For example, China is already at the forefront of the world’s 5G technology standards [44]. Secondly, China’s science and technology further encourages national collaboration in terms of international cooperation, particularly in its cooperation with developing nations. For instance, China assisted the Central African Republic in developing several renewable energy projects and its own internal power network [45]. Third, China has been effective in persuading certain nations to change their pro-Western stances to embrace China in exchange for economic and geopolitical advantages [46]. This has been seen in Pakistan in Asia and especially in Hungary and Italy in Europe. However, things haven’t gone as planned: Italy was under intense pressure from the West to withdraw from China’s Belt and Road Initiative (BRI) after demonstrating support for China [47]. This indicates that China’s smart power still needs to be increased.

6. Obstacles to China’s Scientific and Technological Smart Power

China confronts several significant obstacles to its smart power strategy. Firstly, China’s access to modern technology, particularly in semiconductor manufacturing and high-end electronics, has been hampered by trade restrictions, export controls, and tariffs brought about by the continuous technical struggle with the United States [48]. Additionally, Western nations have been working together to limit China’s technological influence through initiatives like the ‘Clean Network’ programme and limiting Chinese tech companies’ participation in international supply chains. For instance, in response to pressure from the US government, the Dutch government announced on 6 September 2024 that it would increase export licensing requirements for ASML, a company that makes mid-range deep UV (DUV) immersion lithography machines [49].

Secondly, with regard to intellectual property issues, China is frequently accused of stealing intellectual property from outside businesses due to the illicit use of copyright, trademarks, and patented technologies. Concerns over forced technology transfers that might lead to intellectual property theft or unfair competition have been raised by the conditions foreign firms entering the Chinese market sometimes face, such as the need to divulge proprietary technology or create joint ventures with local partners [50]. For instance, Commander claims that in the beginning, ‘Renren’, formerly referred to as ‘China’s Facebook,’ provided friend lists, dynamic updates, and personal homepages [51]. Renren was also initially charged with altering Facebook, particularly with regard to feature design and user interface.

Finally, in regulatory and ethical concerns challenges, China is the largest source of counterfeit products, hurting sectors ranging from luxury items to pharmaceuticals [52]. Despite China's efforts to prevent piracy, counterfeit goods continue to represent a threat to consumer safety and erode brand integrity. Examples of these hazards include the unlawful distribution of software, music, and movies, as well as law enforcement issues.

7. Possibilities to Increase China's Scientific and Technological Smart Power

China might bolster its influence in a variety of ways. Initially, it might enhance global collaboration by endorsing the Belt and Road Initiative and augmenting its financial influence and worldwide infrastructural reach. Strategic investments in infrastructure projects can help to foster long-term partnerships with participating nations, especially emerging ones. Furthermore, China has to become more involved with international organisations like the WHO, WTO, and UN in order to strengthen its diplomatic position and contribute to the development of international norms and standards.

Additionally, China must increase its innovation spending. China has the largest global investment in research and development (R&D) for science and technology, according to the National Bureau of Statistics [53]. Nevertheless, China still needs to invest more, particularly in innovation, to foster the development of innovative industries and to continue funding cutting-edge technologies like biotechnology, quantum computing, and artificial intelligence. These investments are necessary if China is to lead in these fields, set global standards, and influence international technology policies.

Finally, by bolstering domestic intellectual property rights protection and law enforcement, China is promoting norms and sustainability, improving its standing internationally and drawing in more foreign investment and collaboration. In order to further conform with international norms and allay other nations' worries over intellectual property practices, China is also taking part in international talks and agreements on intellectual property standards. This work will standardise laws and policies while enhancing the defence of worker rights, interests, and welfare.

8. Conclusion

It can be said that China has become a scientific and technological superpower that skilfully combines soft and hard power. As noted earlier, China will keep advancing its scientific and technological smart power, and it intends to be at the forefront of global technology innovation, which is why it is investing heavily in big data, 5G, and artificial intelligence. These developments are diplomatic as well as economic instruments. They are reshaping international technology policies and establishing global norms. By promoting innovation and deepening global partnerships, China strengthens its position as a technological powerhouse.

As China makes strides in fields like artificial intelligence, 5G, and space technology, it is challenging Western technical leadership and having a greater impact on international norms and rules. Moreover, the allocation of resources towards technology-enabled diplomacy, spanning research partnerships and educational exchanges, develops durable relationships and transforms international perceptions of science and innovation, particularly in the context of impoverished states. In conclusion, China's scientific and technological smart power is crucial to its global strategy because it aims to position the country as a leader in technological innovation and a significant actor in shaping the direction of world politics and governance.

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