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Article

Cox Asks, China Answers: Advanced Technology and the Possibility of Counter-Hegemony

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Abstract

Unlike mainstream theories of hegemony, this study employs Robert Cox's analytical framework from a critical theory perspective to diagnose how China is challenging the current technological hegemonic order and assess its potential as counter-hegemony. In material terms, China is securing key positions in the global technology supply chain through advanced technological development, expanding its influence in technology-related international organizations, and constructing a new technological governance system through China-centered international institutions such as the Digital Silk Road. Ideologically, China is simultaneously resisting and proposing alternatives to the existing Western-centered ideational framework. Notably, an increasing number of developing countries are adopting Chinese technology, intensifying institutional cooperation with China, and consenting to the alternative ideas China advocates. Taken together, despite certain limitations, China can be understood as being in the process of forming a counter-hegemony in the technological domain.

Keywords

Robert Cox, Hegemony, Counter-hegemony, Technology, International order, U.S.-China hegemonic competition, China

Introduction

Will China challenge American hegemony? Existing research on Sino-American hegemonic competition can be broadly divided into two categories. The realist perspective predicts that inevitable changes in the current international order are forthcoming, as China will necessarily challenge the existing hegemon (Allison, 2017; Mearsheimer, 2014). In contrast, the liberal perspective forecasts that China will either comply with existing international rules or that it will be impossible for China to replace the existing order due to its insufficient capacity

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(Ikenberry, 2018; Zhao, 2018). However, both perspectives possess only partial explanatory power for specific historical periods and lack historical and relational interpretation. The realist perspective emphasizes only the material power aspect of hegemony, while the liberal perspective presupposes that the current order will remain unchanged. In other words, they have the limitation of simplifying hegemony without considering its various constitutive attributes while excluding the historicity and relationality of hegemonic order.

More broadly, existing studies on U.S.–China rivalry have sought to go beyond these paradigms. Some have examined hegemonic order dynamics and institutional balancing (He, 2022; Ikenberry & Nexon, 2019), others have analyzed China's economic statecraft and infrastructure expansion as instruments of hegemonic challenge (Petry, 2023; Wu et al., 2024), and still others have examined China's normative and ideational challenge to the liberal international order (Johnston, 2019; Nanda, 2025). Yet across these strands, hegemony tends to be treated as a set of capabilities or positions to be measured and contested, rather than as a historically evolving process constituted through the interplay of material, institutional, and ideational forces.

Hegemony and hegemonic order exist in a constant state of flux, and research on this subject also requires greater attention to the present within this changing process, as well as to the multitude within the order and the periphery rather than the center. Therefore, this study will move beyond mainstream hegemonic discourse and propose the necessity of a new perspective.

In fact, various definitions of hegemony exist. Simply put, hegemony can be defined as one state having superiority over another (Schenoni, 2019). However, hegemony encompasses both material and ideational aspects and includes the possession and control of power resources across various domains (Griffiths & O'Callaghan, 2002, pp. 137-139). Beyond military and economic domination, structural domination is also possible. If a state can change the status quo of a structure by maximizing its capabilities, it can be judged as hegemonic (Waltz, 1979). Ideological domination, such as influence over norms, values, and ideas, is also possible. Gramsci's hegemony refers to ideological domination through cultural norms, values, and ideas, operating at an intellectual and moral level where the battlefield for domination is ideology itself (Woolcock, 1985, pp. 199-210). Cox argued that hegemony is established through the alignment of material capabilities, a shared image of world order with norms, and institutions that manage this order perceived as having universality (Cox, 1981, p. 139). Nye, classified as a neoliberal, also emphasized the importance of culture, ideology, and institutions as elements of hegemony while acknowledging the significance of economic and military domination (Nye, 2004, p. 7).

However, hegemony is not limited to the concept of dominance alone. Because hegemony extends beyond the state, it is closely related to international order. And because order has historical contingency, hegemonic order can be reconstituted whenever conditions change (Cox, 1983; Goh, 2019). Furthermore, hegemony and hegemonic order are not formed simply through coercion and suppression but are formed and maintained through the consent of other states. Hegemony achieved through power and consent at the systemic level means that other states consent to the position of the dominant state establishing global hegemony. Hegemony can ensure its sustainability not by suppressing the demands of other states through force, but by aligning the system with its own demands (Cox, 1983, p. 171). Particularly in hegemonic competition, challenger states must form consent from other states as counter-hegemony. In other words, they must resist the superiority of the existing order's hegemon and gain consent from multiple states through an alternative model. Of course, competition with the hegemon is inevitable in this process, and struggles for recognition regarding new norms and ideologies arise.

Then how can we verify the degree of hegemonic formation? Technology can serve as a very useful measure in making this determination. Historically, the most critical factor in changes in

hegemonic superiority has been technological innovation (Gilpin, 1981, pp. 116-177; Kennedy, 1989, p. 143). Britain's hegemony in the 18th-19th centuries formed economic dependencies with other states through technological superiority gained from the Industrial Revolution. American hegemony in the 20th century was also due to innovations in electronics and communications technology such as semiconductors and the internet. Following this historical experience, hegemony in the 21st century will be determined by advanced technologies such as artificial intelligence (AI), 5G, semiconductors, and space technology (Thompson, 2020, p. 25).

Second, technological superiority connects to military hegemony. As the history of warfare demonstrates, gunpowder and cannons in the 15th-16th centuries enabled Europe's global hegemonic expansion, and nuclear technology in the 20th century was the foundation for the US-Soviet bipolar hegemonic division. Current advanced technologies are utilized for dual civilian-military purposes, and drone and artificial intelligence technologies are crucial factors in determining the outcome of wars. Technological power is, in essence, national defense power.

Third, structural hegemony in the form of technological standards is also important. Railways were central to continental integration and the formation of global markets, submarine cables enabled Britain's information hegemony, and the internet led to digital hegemony through the global network architecture designed by the United States. The hegemonic effect of technological standards brings not only enormous economic domination but also technological dependency. Depending on which country's technological standard is adopted, the adopting country inevitably deepens its dependence on that country. For example, in the case of railway standards, if a country adopts a particular nation's railway infrastructure project, expansion/improvement after adoption is difficult, making only that country's technology compatible (Zúñiga et al., 2024, p. 1635).

Finally, there is consent regarding technological norms and ideology. A state's ethical values and political preferences are reflected in technological design. For instance, some countries may consider only price and technological capability, while others may prefer technologies from countries with similar ideologies or systemic orientations. Human rights and ethical values may also be placed as the highest priority. An increase in preference for or adoption of a particular country's technological standards or norms means an increase in consent to that country's ethical values or political preferences, and an increase in the degree of consent means that the possibility of hegemonic formation is also enhanced.

This manuscript is part of international relations research on hegemony. Therefore, we wish to acknowledge in advance that there are clear limitations in conducting rigorous comparative analysis of scientific and technological capabilities. Instead, the research interest begins with the question: Does China challenge, or can it challenge, American hegemony through technology as a means? In other words, can China become a counter-hegemony through technology? To this end, the introduction examined the necessity of a new perspective in hegemony research and the importance of technology as a means of evaluation, and will present the hegemony research of Robert Cox, a leading scholar of critical theory, as the analytical framework. Subsequently, the current status of China's hegemonic challenge in the technological domain will be reconstructed according to the analytical framework, and an evaluation will be made as to whether China can indeed become a technological counter-hegemony. Finally, the above discussion will be synthesized and the usefulness of a critical theoretical perspective in research on Sino-American technological competition will be examined.

Cox's Approach to Hegemony

Cox proposed a method for analyzing hegemony and hegemonic order from a perspective different from the mainstream theories of realism and liberalism. Through his proposition that "theory is always for someone and for some purpose," he criticized existing international relations theories for their tendency to legitimize the current order as natural and permanent (Cox, 1981, p. 128). From this perspective, his hegemonic analysis was not merely about measuring power distribution but rather about revealing which social forces seized leadership in specific historical moments and how their interests were presented as universal interests.

Drawing on Gramsci's interpretation, Cox defined hegemony as rule through consent. That is, hegemony is maintained not only through material capabilities but within social and cultural structures where the dominant order is perceived as legitimate and natural (Cox, 1987, p. 7). He defined the international order as a structure formed and maintained by hegemony, consisting of the totality of dominant ways of thinking and norms, emphasizing that this order is not fixed or static but dynamic in the process of historical change (Cox, 1981, p. 139). Therefore, to analyze hegemony and international order, one must examine how hegemonic structures are historically formed and how they are challenged and transformed.

Cox argued that to assess hegemony within a specific historical structure, one must analyze material capabilities, institutions, and ideas. In the international order, a hegemonic state needs not only material superiority but also ideological and institutional leadership to incorporate other states' interests into its own order. First, material capabilities can be simply understood as quantifiable resources such as territory, population, GDP, industrial capacity, and military power, but they also include technological capabilities that form social and historical forces. According to Cox, material capabilities can be viewed from three aspects. One is the dynamic form, which consists of production and technological capabilities, and organizational capacity to construct and operate social and economic organizations. The other is the accumulated form, which includes natural resources transformable through technology, namely material resources, economic resources, and means of production. These material capabilities can be productive or destructive; economic power, productive capacity, and technological innovation are productive, while military power is destructive (Cox, 1981, p. 136). Cox also emphasizes that material capabilities should be understood not as mere total quantity of resources but in the context of production relations (Cox, 1987, pp. 1-9). This is because the same material resources can have different effects depending on how they are organized and utilized. For example, Britain's hegemony in the 19th century was based not merely on the number of factories or coal reserves but on the ability to spread the industrial capitalist mode of production worldwide, and the United States was able to challenge Britain's global hegemony due to its immense industrial capacity rather than simple technology and resources.[1]

Second, institutions are means of maintaining and perpetuating a specific order. Institutions reflect the dominant power relations at the time of their creation and promote collective images that conform to them. According to Cox, because material power relations contain coerciveness, they can legitimize dominant power relations, and institutions can secure acquiescence to specific interests and the leadership of the powerful (Cox, 1981, pp. 136-137). For this reason, institutions are a special form mixing ideas and material power, serving as tools to stabilize and perpetuate a specific order reflecting power relations. Thus, institutions functioned as anchors for major powers' hegemonic strategies. For example, the United States established the global financial system through international institutions it designed after World War II, securing consent by enabling the protection of interests for countries participating in this system. These institutions made possible the spread of liberal values and the maintenance of America's hegemonic status.

Third is ideas. Ideas are broadly divided into two types: one is intersubjective, emphasizing how social relations operate as taken-for-granted assumptions shared in specific historical contexts. These operate as shared concepts about the nature of social relations, namely common sense, and this is the level at which hegemony operates most stably. The other is collective, containing conflicting views on abstract concepts such as the validity of current hegemonic roles, freedom, and justice, which can be contested differently even in the same context. While intersubjective ideas are widely common across a specific historical structure and constitute the common ground of social discourse, there can be multiple collective ideas that may oppose each other (Cox, 1981, p. 136). Therefore, they become subjects of conscious debate and competition, hegemony becomes deeply connected to the recognition of certain ideas by the majority—that is, multiple consents—and counter-hegemonic forces mainly challenge the existing order at this level. For example, during the Cold War, market economy and planned economy competed at the level of collective ideas, but after the Cold War's end, market economy gradually established itself as an intersubjective idea. Additionally, while the main ideas of the current hegemonic order are based on free markets, democracy, and human rights, they may face challenges from other ideas when historical conditions change.

In summary, these three elements—material capabilities, institutions, and ideas—do not simply exist in parallel but interact to constitute the hegemonic structure. Material capabilities provide the material foundation of hegemony, institutions provide mechanisms to organize and spread these capabilities, and ideas play the role of legitimizing all of this and eliciting voluntary consent.

What about the current international order? With China's rise, predictions of changes to the current order are being presented, along with diagnoses of China's power transition or counter-hegemonic potential. However, Cox's approach strictly sets conditions for hegemonic transition, not simple power shifts. Counter-hegemonic forces must go beyond possessing material capabilities to present new institutional frameworks and ideas with universal appeal that can replace the existing hegemonic order. Hegemonic transition becomes possible only when these three elements are coherently combined to obtain widespread consent. At the material capability level, China's rapid rise in economic and military power can be confirmed. Institutionally, China's increasing influence within current international institutions, expansion of China-led institutions such as the Belt and Road Initiative(BRI), BRICS+, and SCO+, are being observed, and ideologically, challenges to existing ideological designs are increasing through the Chinese modernization model, reform of Western-centered international governance, and pluralistic interpretations of democracy and human rights.

Of course, the United States still possesses strong material, institutional, and ideational capabilities. However, as these capabilities decline compared to the past, it is difficult to see the consent of many countries to the current hegemonic order as solid. Even so, international society's consent to China cannot be seen as universal either. In fact, many developing countries are dissatisfied with American leadership and welcome China's material support and institutional alternatives. Nevertheless, they hesitate to apply the Chinese model to their own countries or fully accept Chinese ideas. This shows that China has limitations in converting its material capabilities into widespread institutionalization or ideational consent. In light of this situation, the current international order can be seen as a transitional period of hegemonic transformation, representing not a simple redistribution of power but a process of order dissolution and reconstruction.

What about the technological domain? Does China challenge America's technological hegemony? Or can it become a technological counter-hegemony? The process of finding answers to these questions can also apply Cox's approach. Beyond material capabilities such as China's technological level, one can examine what influence China exercises in technology-

related international institutions and how the existing structure of technological hegemony is thereby challenged and transformed. Observation of how Chinese technologies are perceived and consented to within international society and cultural structures is also possible. Particularly in the technological domain, hegemony includes not just technological superiority but ideological leadership in setting technological standards, establishing technology governance norms, and determining the direction of technological development. For example, the United States has defined the direction of technological development through the Silicon Valley model, open innovation, and personal information protection discourse. For China to become a true technological counter-hegemony, it must go beyond technological superiority in 5G or AI to achieve universal legitimacy for its technological development model. This means not simply a matter of technological capacity but integrated superiority in the three dimensions Cox described.

China's Challenge to Technological Hegemony

Material Capabilities

Cox included technology among the material capabilities of hegemony, as technology shapes social and historical forces in ways previously deemed impossible. To what extent has China secured technological superiority to establish technological counter-hegemony? While technologies are diverse, this analysis focuses on advanced technologies (standards) capable of influencing the hegemonic order.

Advanced technologies largely serve dual civilian-military purposes, thus determining not only future economic power but also military capabilities. They constitute the material foundation of hegemony in the truest sense, encompassing all future industrial sectors. A historical shift is already observable in the advanced technology field, with technological power moving toward China. The Australian Strategic Policy Institute's 2024 report, analyzing data from the past 21 years (2003-2023), declared a complete reversal of technological leadership between China and the United States. According to the report, during 2003-2007, the U.S. led in 60 of 64 advanced technology fields, but this declined to only 7 fields by 2019-2023. Conversely, China surged from 3 to 57 fields during the same period, achieving overwhelming dominance (ASPI, 2024). In another report evaluating technological capabilities based on high-quality scientific research output, China secured first place. Notably, China first surpassed the United States in 2023, and within just one year, the gap widened more than fourfold (Nature Index, 2025).

Additionally, China demonstrates exceptional technological superiority in fields central to future technological competition, such as artificial intelligence and quantum mechanics. During 2019-2023, Chinese institutions published 36.5% of high-impact research in machine learning, while the U.S. accounted for only 15.4% (ASPI, 2024). In natural language processing (NLP), China competes on par with the United States, and industrially, Chinese AI companies such as Tencent and Baidu are making remarkable advances. The emergence of new AI companies like DeepSeek particularly demonstrates the depth and diversity of China's AI industry (IMD, 2025). In quantum technology, China's clear superiority is evident. As of 2024, China holds 60% of global quantum-related patents and possesses the world's largest quantum communication network and two quantum satellites (MERICS, 2024; MIT, 2025, p. 22). According to ASPI data, China maintains overwhelming superiority in photonic sensors (43% of the world's top 10% research, 3.41 times that of the U.S.), quantum communications (31%, 1.89 times the U.S.), and post-quantum cryptography (31%, 2.3 times the U.S.) (ASPI, 2023).

China's dominance in technological standards is also increasing. Technological standards

are central to 21st-century technological competition. Countries that preempt standards can economically enjoy increased patent royalty revenues, enhanced global market access for domestic firms, and requirements for foreign companies to comply with their standards. Furthermore, they can secure leadership in global supply chains, rule-making authority in emerging technology ecosystems, and enhanced technological self-reliance for national security—all constituting the material foundation of hegemony. China demonstrates overwhelming superiority in the 5G standard competition, core to telecommunications technology. As of 2025, China accounts for 40.8% of all 5G standard-essential patent (SEP) families, ranking first globally. In terms of corporate share, among the top 10 companies, Huawei holds 15.0% (1st place) and ZTE 6.4% (6th place), with Chinese companies occupying five positions (Patently Ltd, 2025). Chinese companies not only hold the most 5G standards but also play the most active role in developing and proposing standards. Notably, the adoption rate of Chinese companies' proposals is significant. Proposals submitted by Chinese companies achieved a 33.96% adoption rate, the highest among the top 10 global contributors (World Bank, 2025, p. 24). This indicates that China's technical proposals are not merely quantitatively numerous but qualitatively substantively reflected in standards.

In 5G infrastructure deployment, China also leads in practical standard application. According to China's Ministry of Industry and Information Technology data, by the end of 2023, China had deployed over 3.38 million 5G base stations, establishing the world's largest 5G network (MIIT, 2023; RCR Wireless News, 2024). This demonstrates China's strategic capability to simultaneously lead both standard-setting and actual implementation. For 6G, core to future telecommunications technology, though standardization is still in early stages, China has already secured a leading position by filing the most related patents (World Bank, 2025, pp. 24-25).

China's technological standard superiority extends beyond telecommunications into various industries. Particularly in high-speed rail, China is a global leader in standard-setting. China has established all 13 system-level international standards for high-speed rail created by the International Union of Railways (UIC). This demonstrates that China has moved beyond merely participating in standard-setting to monopolistically leading specific fields. According to WIPO data, China's transportation patents were only 7.59% of the global total in 2010 but surged to 39.35% in 2023. This represents 2.7 times Japan's share (2nd place) and 3.4 times the U.S.'s share (3rd place) (World Bank, 2025, p. 26). Additionally, as China surpasses the West in various emerging technology fields including telecommunications, quantum, and electric vehicles (EV), it plays a leading role in standardization and innovation. Chinese companies own patents in numerous next-generation technologies and occupy leading positions in setting global standards in these fields (Gargeyas, 2021).

While the U.S. undeniably maintains absolute superiority in advanced technology fields, China's advanced technology superiority appears comprehensively across all dimensions, including research papers, patents and standards, and infrastructure construction, not confined to specific indicators or fields.[2] This clearly demonstrates that China has transitioned from mere follower to leader in technological material capabilities.

Institutions

Cox viewed institutions as means of maintaining and perpetuating hegemonic order. China's exercise of influence in technology-related institutions is an important indicator for assessing technological hegemony. First is the expansion of influence within current technology-related international institutions. In major international standardization organizations such as the International Telecommunication Union (ITU), International Organization for Standardization

(ISO), and International Electrotechnical Commission (IEC), China is leading the establishment of international standards for advanced technologies including machine learning and big data (Yoon & Baek, 2025, p. 162). Evidencing this, Chinese nationals have been elected to leadership positions in international standardization organizations. ISO operated under Chinese leadership from 2015-2017, IEC from 2020-2022, and ITU from 2015-2018 including re-election. Activity and participation within these organizations have also surged. From 2011 to 2021, the number of Chinese secretariats for ISO technical committees (TC) and subcommittees (SC) increased by 58%, while in IEC, they increased by 67% from 2012 to 2020. While major Western countries such as Germany and the U.S. still maintain 1st and 2nd place in various indicators, they show little change compared to China's growth rate (USCBC, 2024). This signifies China's expanding substantive influence in standard-setting direction through agenda-setting and priority adjustment within these organizations.

Simultaneously, participation in technical standardization committees is expanding. Standardization committees are expert groups within international standardization organizations (ISO, IEC, ITU) that develop and establish standards for specific technical fields. China has strategically exercised influence on the international standardization of its technologies through strategies including securing leadership positions such as chairs and vice-chairs in committees and securing multiple experts at each stage, emerging as one of the standardization powers (Rühlig, 2023, pp. 57-58).

Second is the expansion of Chinese-style technological standards and infrastructure. China is disseminating information and communication technology standards and infrastructure through state-led initiatives such as the BRI, Digital Silk Road, Made in China 2025, and China Standards 2035. China-led information and communication infrastructure construction subsequently links with digital free trade zones, e-commerce, and smart city systems, bringing signatory countries under China's digital governance influence. For example, Chinese information and communication companies are leading new global information and communication technology standards and systems by increasing their share in space through *Beidou* satellites, on land through information and communication infrastructure, and at sea through submarine cables.

The *Beidou* satellite system, with approximately 48 satellites as of 2024, has numerically surpassed the U.S. GPS (31 satellites) and is assessed to possess technological superiority (Krieszis, 2024; New Space Economy, 2024). Over 140 countries worldwide have adopted the *Beidou* system, with 30 African countries, most ASEAN nations, and major Middle Eastern and Central Asian countries incorporated into China's satellite ecosystem through Belt and Road Initiative linkages (Union Rayo, 2025). Next is the expansion of information and communication infrastructure. Through the Digital Silk Road, China is constructing a comprehensive ICT ecosystem including communication infrastructure and data centers. As of 2024, Huawei maintains its position as the world's largest supplier with over 31.3% market share in the approximately $35 billion global RAN market, supporting networks for over 1,500 telecommunications operators in more than 170 countries and regions (Weissberger, 2025). Alibaba is expanding data center construction and Alipay into Southeast Asian markets including Indonesia.

Another aspect is submarine cable occupation. Submarine cables are the information highway carrying over 95% of global internet traffic and strategic infrastructure for the big data era. Chinese submarine cable companies own or were involved in constructing 29.7% of existing cables based in Asia and occupy 54.2% of planned cables. Expanding globally, China directly or indirectly influences 11.4% of existing cables and 24% of planned cables (CSIS, 2019). Particularly, China's HMN Technologies constructed 18% of global submarine cables (based on total deployment length) over the recent four years (2020-2024), emerging as the world's fastest-

growing company over the past decade (CSIS, 2024).[3]

Third is the expansion of technology and standard cooperation through China-led international institutions. Representative examples include activities within BRICS+ and SCO+, where China's considerable influence and the participation of non-incumbent power countries can represent counter-hegemonic character. BRICS countries, at China's proposal, promoted a joint working group on digital technology and AI, officially announcing the BRICS+AI Alliance in 2024. Over 20 technology companies from China, Russia, Brazil, Iran, and others participated in this alliance, including AI development specialist institutions from China and India (Gibadyukov, 2025). Additionally, China declared information and communication technology (ICT) security cooperation with BRICS countries and full support for digital payment systems (BRICS Pay). Particularly through the BRICS+ platform, China has advocated AI governance declarations with strong Chinese ideological characteristics, emphasized preventing AI technology inequality between developed and developing countries, and highlighted China's technological contributions (BRICS, 2025).

Within the Shanghai Cooperation Organization (SCO+), China has also promised to strengthen AI cooperation with member countries, emphasizing "equal rights of all countries to AI development and use"—differentiated from technologically advanced countries. Particularly, President Xi Jinping declared the establishment of scientific and technological innovation cooperation centers and technology education centers, stating that China will play a role in ensuring that all member countries can enjoy the benefits of AI development and the *Beidou* satellite system (Xi, 2025). This emphasizes China's role as a technology-leading country providing public goods to member countries sharing institutions. The China-CELAC Forum has also established various technology cooperation frameworks between China and Latin American countries. Through this, China's 5G communication infrastructure and other advanced IT products, software, and platform technologies and technical standards are spreading. Particularly, Chinese companies' entry into digital transformation fields including communication networks, security, e-commerce, fintech, data centers, and smart cities is noticeably increasing (Ellis, 2022).

Ideational Design

China advocates for global technology governance reform as resistance to existing Western technological hegemony. Xi Jinping has explicitly stated that global rules cannot be imposed by "one country or a handful of countries" (Xi, 2021). If past global rules were indeed dominated by the West in reality, this implies the possible emergence of new rules led by China. China presents an ideational design fundamentally different from the current technological hegemonic order.

A representative example is China's concept of cyber sovereignty (*wangluozhuquan*). This was officially introduced in 2010 when the Chinese government specified that "within Chinese territory, the internet is under the jurisdiction of Chinese sovereignty," and gained momentum when President Xi emphasized in a 2015 World Internet Conference keynote that "countries should mutually respect each other's rights to independently choose their internet development paths, internet management models, and internet public policies" (Ministry of Foreign Affairs of PRC, 2015; State Council Information Office of PRC, 2010). This concept conflicts with existing Western-centered multistakeholder discourse. The existing discourse emphasizes freedom of expression and free flow of information under liberal norms and the importance of non-state stakeholders including industry, academia, and non-governmental actors. Therefore, it holds that cyber international order should be based on openness, inclusiveness, bottom-up cooperation, and consensus decision-making. In contrast, Chinese discourse emphasizes individual countries' sovereign governance, thus demanding a multilateral approach to cyber international order

suited to each country's culture and political system, emphasizing the importance of government intervention and the leading role of the world government—the United Nations (Qiao-Franco, 2024; Zeng et al., 2017).

One collision point between the two discourses is sovereignty vs. openness. The exclusivity of classical state sovereignty contradicts the internet spirit based on the concept of unlimited interconnectivity. Emphasizing cyber sovereignty could lead countries to create their own separate cyberspace, resulting in internet fragmentation. Another is state control vs. human rights. Fundamental opposition inevitably exists between the principle of freedom of expression and free flow of information and the cyber sovereignty concept that can restrict them. China perceives Western multistakeholder discourse as a potential threat to state sovereignty and expects that developing countries need the concept of cyber sovereignty to escape Western cyber colonialism.

Second is the discourse of state-led technological development. While Western technological development models emphasize market mechanisms and individual free innovation, China defines technological development as new productive forces alongside traditional production factors. This distinguishes it from the market-oriented reform and opening era and signifies a return to Marxist economic policy approaches and Chinese Communist Party-led economic programs (Kroeber, 2024). That is, China reconstructs technological development not as a mere economic tool but as an ideological project demonstrating the superiority of the socialist system, presenting it as an alternative development path different from capitalist market logic.

This connects with the recent active promotion and dissemination of the "Chinese-style modernization (*zhongguoshi xiandaihua*)" model of development with Chinese characteristics. The Chinese-style modernization concept, formalized at the 20th Party Congress in 2022, opposes the existing formula that modernization equals Westernization. That is, while Western capitalist modernization resulted in wealth concentration among the few, Chinese-style modernization realizes common prosperity for all people (Xi, 2022). This can be considered strategic discourse construction that, unlike Western experience where technological development inevitably deepened inequality, China can become an alternative simultaneously achieving technological innovation and community justice through its development model. Additionally, China emphasizes the historical inevitability that science and technology must be mastered to realize the Chinese Dream of the great rejuvenation of the Chinese nation, as China's modern decline stemmed from missing the technological revolution (State Council of PRC, 2016). This utilizes the historical victimization narrative by Western imperialism to secure legitimacy for state-led technological development and form ideological consensus particularly with developing countries.

Third, in AI ethics and regulation, community interests take priority over individual interests. While Western models emphasize individual privacy and autonomy, China argues that AI should prioritize social harmony and stability. Therefore, AI governance also requires comprehensive regulatory systems, leading to the logic that national roles must be emphasized and internationally, UN intervention as world government is necessary. Particularly, through the "Global AI Governance Initiative" proposed by Xi Jinping in 2023 and the 2025 "Global AI Governance Action Plan," China proposed eliminating algorithmic bias, balancing technological progress with risk prevention and social ethics, and establishing comprehensive and interoperable standard systems. Simultaneously, China emphasizes that since AI is humanity's common asset, all countries should equally enjoy the benefits of AI development (Ministry of Foreign Affairs of PRC, 2023, 2025). These Chinese claims position China as a reformer of global technology governance by advocating communitarian values against Western individualistic rights discourse and criticizing Western technological monopoly and digital divides.

Comprehensively, these Chinese ideas represent a new challenge to existing Western-dominated ideational designs. This is dissatisfaction with and resistance to the ideational

foundation of the current technological hegemonic order dominated by Western liberal norms and multistakeholder values. Ultimately, China's resistance reflects fundamentally different philosophical perspectives on the role of the state, individual and community values, and international order governance and norms. This constitutes one of the most important ideational challenges of the 21st-century digital era and will be a key factor determining the future of global technological hegemonic order.

Can China Become a Counter-Hegemonic Power?

Cox applied Gramsci's concept of hegemony to international relations, emphasizing the importance of counter-hegemony in transforming the international order. Counter-hegemony refers to organized efforts to create an alternative order that challenges existing dominant values, worldviews, and common sense, while representing the interests and values of subordinate classes or marginalized groups. Cox argued that the formation of counter-hegemony requires consensual resistance among social forces, thereby underscoring that consent is as essential to counter-hegemonic formation as it is to hegemonic formation (Cox, 1981). Material capabilities, institutional influence, and an attractive ideological framework capable of forming counter-hegemony constitute the foundation for eliciting consent. Building consent represents the culmination of current counter-hegemonic or revisionist efforts.

As discussed above, China's technology demonstrates superior material capabilities, expanding institutional influence, and an ideological design that differentiates itself from existing ideologies. Most notably, the diffusion of advanced technology and technological standard infrastructure has yielded visible results, particularly among developing countries. This suggests that a growing number of states are increasingly consenting to China's technological prowess and technological infrastructure. Admittedly, objectively assessing this consent is not straightforward. The level and degree of consent may vary by country or technology, and it is difficult to distinguish whether the consent itself is genuine or a coerced consent resulting from economic dependence. However, by examining why numerous countries, particularly developing nations and Global South countries, consent to China's technology, institutions, and ideological framework—or in what form they express their consent—a preliminary diagnosis of China's counter-hegemonic potential becomes feasible.

Economic Attractiveness

China's technology possesses distinct economic advantages. Beyond already-proven technological capabilities and superior price competitiveness, various supplementary services are provided. The primary reason African and developing countries adopt Chinese technological infrastructure lies in their ability to substantially address their infrastructure gaps at low cost within a short timeframe. From these countries' perspective, China's affordable yet high-quality and rapid solutions represent highly attractive alternatives.

Generally, for developing countries facing technological infrastructure deficits, China provides large-scale financial support through the BRI, thereby presenting opportunities for these nations to narrow their infrastructure gap with the West and accelerate economic growth within a short period. Under such circumstances, long-term security risks or issues of dependence on China become relatively deprioritized. As a concrete example, Huawei's communication technology and infrastructure were frequently offered at prices more than 30% lower than Western enterprises, supported by massive loan assistance from Chinese financial institutions and government

subsidies (Bartholomew, 2020). Furthermore, technology transfer programs were implemented concurrently. Chinese technology companies developed systematic knowledge transfer strategies, including job creation in developing countries, establishment of academies for local workforce training and technological capacity enhancement, organization of technology competitions, and provision of scholarships for outstanding talent (Kadi & Djeflat, 2024).

The *Beidou* satellite system's increasing adoption rate in developing countries also follows a similar pattern. First, China provided basic services free of charge while simultaneously offering investments and subsidies to encourage developing countries to adopt the *Beidou* system, continuously investing in the system's long-term advancement (Chen, 2024). For instance, Thailand jointly established a natural disaster monitoring and prediction system utilizing *Beidou* with China, with China bearing the entire project cost (Choi, 2013). Additionally, the explosive growth of Chinese digital platform technologies such as TikTok or e-commerce in Global South countries stems from their business models offering easier accessibility than Western platforms. This economic attractiveness has induced numerous countries to cooperate with Chinese technology companies, naturally expanding China's technological standards and increasing its influence in the process.

Meeting Demand

China's technology diffusion strategy satisfies the demands of numerous developing countries. A representative example is the Digital Silk Road. This constitutes a core component of China's BRI strategy—a strategic mechanism for exporting digital infrastructure and technology to developing countries. This strategy, which was officially announced by President Xi Jinping at the first BRI Forum in 2017 when he proclaimed the construction of a 21st-century Digital Silk Road, comprises hardware infrastructure such as 5G networks, fiber optic cables, and satellites; soft infrastructure including e-commerce and cloud services; and smart city technology as its main components. As of 2025, BRI participating countries number approximately 150, with a significant portion also participating in the Digital Silk Road (Belt and Road Portal, 2025). The core success factor of this strategy is an integrated approach providing finance, technology, and infrastructure as a single package. Financial support from Chinese state-owned banks enabled Chinese technology companies to supply technology and infrastructure at prices more than 30% lower than Western competitors (Bartholomew, 2020). In terms of market selection, China strategically concentrated on Africa, Southeast Asia, the Middle East, and Latin America—regions where Western companies hesitated to enter due to insufficient profitability and political risks. As these countries had high demand for digital infrastructure but lacked their own financial resources, China's integrated solutions accompanied by financial support demonstrated strong competitiveness and attracted participation from numerous countries.

China's technology diffusion strategy extends beyond physical infrastructure construction to customized science and technology cooperation for developing countries. The Alliance of National and International Science Organizations for the BRI (ANSO), launched in 2018, is representative. This alliance primarily consists of scientific research institutions from BRI participating developing countries, possessing 78 member institutions from 52 countries as of 2025. Under the principles of "extensive consultation, joint contribution, and shared benefits" advocated by the BRI, the alliance operates various cooperation programs for scientific and technological innovation and capacity building, particularly focusing on supporting developing countries' scientific capacity enhancement (ANSO, 2025). Furthermore, China has concluded science and technology agreements with governments of over 80 countries as of 2025. Notably, cooperation partners are shifting from developed countries such as the United States to Global

South countries. This suggests China is achieving a full-scale status transition from technology recipient to technology provider (Han, 2025). Thus, the Digital Silk Road as a national strategy and the expansion of science and technology cooperation are likely to result in heightened dependence on Chinese technology among numerous developing countries and Global South nations excluding developed countries, forming a support base.

New Alternative

China's technology is emerging as a new alternative. While emphasizing its role as a provider of technological public goods, China is simultaneously promoting the construction of an open technology ecosystem as an alternative to the exclusive technological control of the United States and the West. This is highly welcome from the perspective of developing countries that have harbored significant discontent regarding technological inequality. Through the Global Development Initiative, Global AI Governance Initiative, and other frameworks, China has pledged science and technology cooperation and support with developing countries, declaring its commitment to contributing to bridging the digital divide between nations. In particular, China has promised on multiple occasions at international conferences including the UN to support AI infrastructure development in Global South countries (Ministry of Foreign Affairs of PRC, 2024a). These declarations are part of a strategy to position China not merely as a technology competitor but as a rule-maker in global science and technology governance and a public goods provider, containing intentions to elicit support from numerous developing countries.

Concurrently, China is pursuing an open ecosystem in opposition to the closed AI ecosystem of the United States and the West. A representative example is DeepSeek's open model. By providing AI systems as open source, this model enables users worldwide to customize according to local requirements in various fields such as healthcare, education, and labor. In terms of technological level, the general assessment is that it falls somewhat behind major closed models produced by American companies such as OpenAI. However, from developing countries' perspective, it is gaining international favor in that it enables expansion of AI infrastructure foundations at low cost and enjoyment of AI technology benefits (Daniels & Dohmen, 2025).

From developing countries' perspective, adoption of Chinese technology provides the following strategic advantages. First, securing technological sovereignty and independence. Dependence on a single Western-dominated supplier can be escaped. While developing countries' adoption of Chinese technological infrastructure may be evaluated as expanded dependence on China, paradoxically, the effect of enhanced negotiating power can be expected in that diversified options are created compared to American technological monopoly. Second, avoidance of camp selection and strengthening of negotiating power. In the case of ASEAN countries, when U.S. sanctions on Huawei 5G equipment became controversial, they presented a diversification approach utilizing Western companies together rather than depending solely on Huawei (China Daily, 2019). Economically, they induced competition between suppliers to reduce prices, while strategically securing the convenience of not having to choose sides between the United States and China. The background enabling countries like ASEAN to strengthen their negotiating power regarding technology adoption amid intensifying U.S.-China advanced technology competition can be understood in this context. Third, developing countries can resolve their core economic development challenges. For these countries, immediate economic priorities such as poverty reduction, job creation, and infrastructure construction take precedence over long-term security concerns and geopolitical considerations. In this context, China's technology, with its weak political conditionality and price competitiveness, cannot help but become an attractive alternative.

Ideological Consensus

China's technology ideology emphasizes cyber sovereignty, technological egalitarianism, development prioritism, and community of shared future values. This stimulates consensus among Global South countries that have been excluded from the existing Western-centered order. This ideological approach particularly attracts attention in that it presents an alternative vision to the existing structure where benefits of technological development have been concentrated in a small number of developed countries. Governments, regional organizations, and scholars of the Global South have criticized the structure wherein data, infrastructure, and AI technology are primarily produced and controlled by large corporations and states in the Northern Hemisphere, resulting in inequality, bias, and sovereignty infringement, with tendencies to ignore local cultures, languages, and policies. This criticism goes beyond merely pointing out technological gaps to problematize the structural inequality and neocolonial character of the global digital order. They demand cyber sovereignty, regional infrastructure, and local capacity enhancement. For example, the Pan-African Parliament emphasized Africa's digital sovereignty, raised concerns about data and AI control by external forces, and urged strengthening of autonomous policy and regulatory capabilities (PAP, 2025). India also uses the expression "Colonial era of AI," criticizing how dependence on foreign platforms and data creates issues of sovereignty and agency (Arora & Jyotsna, 2025).

China defines itself as a Global South country and presents a framework for South-South cooperation in technology. China criticizes that "some countries are politicizing technologies and using them as weapons and tools to divide the global internet and threaten global digital development and cooperation," asserting opposition to "technological monopoly and unilateral coercive measures." It also emphasizes that "countries should respect cyber sovereignty and respect the right of each country to independently choose its digital development path according to its national conditions," stressing that "the right to development is a fundamental and inalienable human right" (Ministry of Foreign Affairs of PRC, 2021). Furthermore, emphasizing the need to bridge the digital divide and that no developing country should be left behind in technological development, China pledges to expand digital cooperation with Global South countries. Consequently, official support from Global South countries for China's ideology is increasing.

The most explicit case of official consent is the UN AI capacity-building resolution led by China in July 2024. This resolution was officially adopted with consent from 143 countries based on active support from Global South countries (Xinhua, 2024). This represents overwhelming support corresponding to approximately 74% of the UN's 193 member states, demonstrating that China's AI governance ideology has secured a broad support base in the international community. Major contents include strengthening developing countries' AI capabilities, bridging the digital divide, and creating a fair and non-discriminatory business environment, essentially reflecting core principles of the Global AI Governance Initiative proclaimed by Xi Jinping in 2023. Even before this resolution's passage, China formed ideological consensus through the Global Digital Compact with the Group of 77, a developing country grouping, at the UN. This document emphasized the importance of cyber sovereignty, stating that "countries must reaffirm their sovereign right to determine rules for internet use within their territories and govern the digital domain within their jurisdiction according to international law," and stressed that countries should exercise appropriate control over technology companies and platforms under their jurisdiction, with external stakeholders required to comply with national laws and norms (Group of 77 and China, 2023).

Official diplomatic documents also increasingly express explicit consent to China's technology ideology. In the 2024 joint declaration of the Forum on China-Africa Cooperation (FOCAC),

where heads of state from 53 African countries participate, expressions were formalized wherein the African side welcomed and consented to China's Global AI Governance Initiative, and expressions of gratitude were used for China's efforts to promote developing countries' rights (Ministry of Foreign Affairs of the PRC, 2024b). Similar expressions of consent were formalized in joint statements between China and ASEAN. In the joint statement adopted at the 2020 ASEAN-China Cyber Dialogue, ASEAN expressed appreciation for China's efforts including the Global Data Security Initiative (Ministry of Foreign Affairs of PRC, 2020).

Moreover, China announced a concrete Action Plan for Global AI Governance Reform in July 2024, after which China's technology ideologies have been reflected in joint declarations of numerous global multilateral cooperation bodies. In 2025 as well, China-led technology ideologies were reflected in BRICS's Global AI Governance Statement and SCO's Tianjin Declaration, including equal rights and strengthened cooperation in AI (community interests over individual interests), digital sovereignty and right to development (sovereignty over openness), and meaningful participation of developing countries and the Global South (resistance to existing Western order) (BRICS, 2025; SCO, 2025). Additionally, evidence of increasing numbers of countries consenting to China's technology ideology includes the growth in member states of practical cooperation groups linked to Chinese ideology on the international stage. China formed the Group of Friends for International Cooperation on AI Capacity-Building in December 2024, with over 80 countries participating since its establishment, expressing willingness to cooperate in bridging the digital divide with developed countries (Permanent Mission of the PRC to the UN, 2024).

Conclusion

This manuscript analyzed how China is challenging the current technological hegemonic order through Cox's approach (material capabilities, institutions, and ideas). In terms of material capabilities, China is surpassing the United States in advanced technology fields such as AI, 5G, and quantum technology, securing a pivotal position in the global technology supply chain through preemption of patents and technological standards. At the institutional level, China is expanding its influence in international standardization bodies such as the ITU and ISO, while constructing an alternative China-centered technological governance system through the BRI and the Digital Silk Road. Ideologically, China presents both resistance to and an alternative against the existing Western-centered ideological design by emphasizing cyber sovereignty, state-led technological development, and technological equality and communitarianism. Moreover, from the perspective of consent, China is continuously expanding the adoption rate of Chinese technology by meeting the practical needs of developing countries through low-cost, high-efficiency technological infrastructure and financial support, while securing broad consent from Global South by presenting critiques of and alternatives to existing Western-centered technology governance. Particularly, there is an increasing trend of cases where ideological designs related to advanced technologies such as AI are crystallizing direct consent from numerous countries. In sum, can China become a counter-hegemonic power? To Cox's question, one can answer with a degree of possibility.

However, limitations remain in this answer. First, in terms of material capabilities, institutions, and ideological design, the question arises whether China can secure overwhelming superiority over the current hegemon—the United States—and Western advanced countries. While it is clear that China's superiority appears in certain advanced technology domains and this trend is expanding, historical precedent cautions against overgeneralization. Japan's dominance in

electronics and manufacturing in the 1970s–1980s illustrates that technological superiority in specific domains may be domain-specific and does not constitute a sufficient condition for hegemonic transition. The checks from the hegemon and vested interests remain formidable, and more historical time is needed to ascertain the outcome.

Second, regarding consent, while it is evident that consent from Global South countries is expanding, it remains unclear whether their consent is voluntary or the result of unavoidable choices. Particularly, a gap exists in whether the adoption of technological standards and acceptance of infrastructure can be equated with ideological consent. Especially, China's advanced technology faces criticism for lacking safeguards regarding universal norms such as human rights and values. From this perspective, China inevitably possesses weak moral and normative legitimacy as a counter-hegemonic power.

Above all, questions can be raised about utilizing Cox's hegemonic concept through a state-centric approach in the current U.S.-China technological hegemonic competition. Cox emphasized the role of social forces beyond the state and advocated for counter-hegemony from below. As he also emphasized internalized consent, one might criticize that the consent-related cases discussed above differ from Cox's concept. However, this study's approach can be justified on the following grounds. First, numerous neo-Gramscian studies following Cox's tradition have already linked China's rise to counter-hegemonic discussions. Second, even if currently observed phenomena—the diffusion of Chinese technology, increased cooperation with China in international institutions, and expressions of support for China in official diplomatic documents—are difficult to classify as complete consent at present, the process itself of these practices accumulating and layering will be historically recorded. Looking back after time has passed, this can be evaluated as a process through which consent was being formed.

Is China a counter-hegemonic power? This is naturally a contentious question. This manuscript does not definitively conclude that China is a counter-hegemonic power. Rather, it diagnoses China's position and influence in the current international order, particularly in the technological domain, and presents empirical evidence for assessing the possibility of future counter-hegemony. Ultimately, this study's contribution lies in reconfirming that Cox's methodology can still serve as a useful analytical framework when analyzing hegemonic transformation at the current historical juncture.

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Conflict of Interest

The authors declare that there are no conflicts of interest in this research.

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Notes

1. Cox's 1987 work places particular emphasis on production relations as a foundational analytical category, arguing that the social organization of production generates the social forces that underpin historical

structures. While this study draws on Cox's three-component framework—material capabilities, institutions, and ideas—as constitutive elements of historical structure at the level of world order, a fuller engagement with production relations remains an avenue for future research.

2. Regarding the AI industry, the United States maintains superiority in holding various patents and intellectual property rights. NVIDIA leads in AI accelerators, AWS/Azure/GCP dominate cloud infrastructure, and companies such as Google, Meta, OpenAI, and Anthropic spearhead foundational AI models (Goujon, 2024).
3. Despite U.S. efforts to contain China's rise in this domain through initiatives like the 2020 Clean Network and 2023 QUAD Submarine Cable Partnership, China's growth trajectory remains difficult to halt. For more on this, see (Lee & Kim, 2025).

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