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CHINA *local / global*

How Saudi Arabia Bent China to Its Technoscientific Ambitions

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China Local/Global

China has become a global power, but there is too little debate about *how* this has happened and what it means. Many argue that China exports its developmental model and imposes it on other countries. But Chinese players also extend their influence by working through local actors and institutions while adapting and assimilating local and traditional forms, norms, and practices.

With a generous multiyear grant from the Ford Foundation, Carnegie has launched an innovative body of research on Chinese engagement strategies in seven regions of the world—Africa, Central Asia, Latin America, the Middle East and North Africa, the Pacific, South Asia, and Southeast Asia. Through a mix of research and strategic convening, this project explores these complex dynamics, including the ways Chinese firms are adapting to local labor laws in Latin America, Chinese banks and funds are exploring traditional Islamic financial and credit products in Southeast Asia and the Middle East, and Chinese actors are helping local workers upgrade their skills in Central Asia. These adaptive Chinese strategies that accommodate and work within local realities are mostly ignored by Western policymakers in particular.

Ultimately, the project aims to significantly broaden understanding and debate about China's role in the world and to generate innovative policy ideas. These could enable local players to better channel Chinese energies to support their societies and economies; provide lessons for Western engagement around the world, especially in developing countries; help China's own policy community learn from the diversity of Chinese experience; and potentially reduce frictions.

Evan A. Feigenbaum
Vice President for Studies, Carnegie Endowment for International Peace

Introduction

Technoscientific cooperation between the People's Republic of China (PRC) and Arab states has blossomed in recent years.[1] The phrase itself has become an official "watchword" (*tifa*) in the context of Sino-Arab relations, suffusing nearly every official policy paper or statement on the Arab world from Beijing, including its Arab Policy Paper (2016), the China-Arab States Cooperation Forum Action Plan (2020), and the Ministry of Foreign Affairs' Report on Sino-Arab Cooperation in the New Era (2022).[2]

Yet this newly hailed "breakthrough" (*tupo*) has attracted both scrutiny and concern from Western officials and academics worried about their states' influence in the Middle East and, perhaps more pertinently, the outcome of their perceived ongoing global competition with China. The anti-Huawei campaign waged across the Gulf states by American officials during the end of Donald Trump's presidency and the beginning of Joe Biden's was animated by questions shaped by these anxieties: Will access to, and adoption of, Chinese technologies lead to the diffusion of new distinctively "Chinese" norms and standards (such as Chinese conceptions of cyber sovereignty) or barriers to unfettered Western market access over the long run? Will these same technologies compromise national digital ecosystems and infrastructures, thereby allowing the PRC to access sensitive information surrounding Western technologies and military deployments in the region while imposing its own distinctively Chinese vision on the region? And to what extent will these processes of technoscientific borrowing embolden authoritarianism and potentially take these states out of a Western security orbit?[3]

Such questions are neither new nor limited to the Middle East. The PRC's complicated entanglements in Africa over the past few decades have produced similar-sounding concerns from the West surrounding a range of issues including Chinese "debt trap diplomacy" and resource exploitation, to which scholars such as Deborah Brautigam, Ching Kwan Lee, and Lina Benabdallah have provided nuanced counternarratives.[4] Inspired by these works' emphasis on local factors that China adapts to rather than the "Chinese ways" that Beijing and its proxies ostensibly impose, and also seeking to address some of the (primarily) Western apprehensions on Sino-Arab technoscientific cooperation, this paper focuses on a single regional actor—the Kingdom of Saudi Arabia, a major comprehensive strategic partner (*quanmian zhanlüe huoban*) of the PRC.[5]

The paper is anchored by the contention that technoscientific development in Saudi Arabia reflects, above all, the objectives and strategies of the Saudi state in its pursuit of technoscientific self-strengthening. In approaching this topic from a local perspective, this analysis seeks to upend conventional narratives that view these transformations mainly through the prism of China's rise, or that of the U.S.-China rivalry. There are dreamers and planners beyond those in the Beltway and

Zhongnanhai, such as those in al-Yamamah Palace, and their ambitions must be taken into account in understanding the nature, scope, intensity, velocity, and specifics of their collaborations with China.

The paper is divided into three sections. The first discusses the evolution of Saudi Arabia's approach to technoscientific development. It serves to shed light on the underlying logic guiding the kingdom's global search for technoscientific partnerships. The second focuses on Chinese-Saudi technoscientific cooperation and localization projects, providing a general overview of the history of such cooperation followed by a discussion of some of its structural trends and impediments in terms of human resources, the circulation of capital, and the role of the state versus the private sector. The third and final section dwells on some of the key takeaways and contextualizing lessons based on the previous sections' findings.

The Past and Present of Saudi Technoscientific Development

From being the first state in the in the world to grant citizenship to a robot, to the ongoing construction of NEOM—the futuristic smart city planned in the northwestern province of Tabuk—the kingdom has purposefully clothed itself in the aesthetics of the cutting edge.[6] At the conclusion of the Sino-Arab summit held in Riyadh in December 2022, Saudi Crown Prince Mohammed bin Salman declared, "We affirm to the whole world that the Arabs will compete in the race for advancement and refinement once more!"[7] While such actions and statements might be decried by some observers as performative instances of technowashing and national rebranding to distract from the country's human rights record, these assessments miss the larger and more salient point that the mastery of science and technology lies at the very heart of the contemporary Saudi state's greatest aspiration: to obtain, to borrow a phrase from the Qing Dynasty reformers of China's imperial period, "wealth and power" (*fuqiang*).[8]

Although there may be a temptation to attribute this ambition to Saudi Arabia's Vision 2030 (launched in 2016), or to even treat it as a delayed emulation of the technomodernism embraced by neighboring Gulf states (most notably the United Arab Emirates), it is in fact much older in origin.[9] In the 1970s, awash with newfound oil wealth and seeking to modernize its economic base and bureaucratic apparatus, the Saudi state began to formulate a strategy for technoscientific development.[10] To that end, it established the Saudi Arabian National Center for Science and Technology (refashioned into the King Abdulaziz City for Science and Technology, or KACST, in 1985) as a government super–think tank and research-coordinating body.[11]

Akin to the Chinese Academy of Sciences (CAS), KACST is composed of an ever-expanding number of institutes, laboratories, and centers sustained by generous funding, cumulatively receiving over $1.1 billion between the 1985 and 1990 budgetary allocations.[12] The institution has rendered important services to the Saudi state and continues to do so, conducting experiments into strategic technologies such as solar, nuclear, and desalination; developing legal frameworks for scientific research such as the Patent Law; and hosting the national data route for the internet.[13] Technology transfer was, and remains, a key mandate of KACST; in the 1980s, key partners included the United States (where it maintained a program office), Canada, and the Republic of China (Taiwan), with which Riyadh once had diplomatic relations.[14]

The acquisition of key technologies (or, more accurately, technological products) accelerated in the 1980s, for example with respect to modern telecommunications—a pursuit that enabled Saudi Arabia to become a significant player in pan-Arab media over the following decades.[15] In 1976, it participated in the founding of the Arab Satellite Communications Organization (Arabsat), an intergovernmental entity that now operates a sizable fleet of satellites providing radio and television coverage across much of the Arab world. The kingdom is the organization's largest shareholder (36.6 percent) and host to its headquarters (in Riyadh).[16]

When Arabsat's second satellite was launched in June 1985 via NASA's space shuttle *Discovery*, the mission was accompanied by Prince Sultan bin Salman as a payload specialist—making him the first Arab and the first Muslim to go to space.[17] This symbolism remains powerful. The nascent Gulf space programs of the twenty-first century continue to invoke the prince's extraplanetary journey as an inspirational tale, and as the current monarch's eldest son, Prince Sultan was appointed chairman of the Saudi Space Commission (established in 2018) until he was relieved of his duties in 2021.[18]

The 1990s heralded a change in Saudi state attitudes toward this purely acquisitional approach. As noted in the *Fifth Development Plan* report, "the most prominent science and technology issue facing the Kingdom concerns the gap between the level of technology used . . . and that which Saudi Arabia can adapt or produce itself."[19]

This problem of being able to handle and reproduce technologies—let alone to develop them from scratch—added to the preexisting challenge of continued economic modernization during a post–Cold War period defined by sustained low oil prices. The Saudi state, in an attempt to tackle these problems, unveiled a National Science, Technology, and Innovation Plan (NSTIP) in 2002.[20] Designed by KACST and implemented in coordination with various government bodies (ministries, agencies, and national committees) and the private sector, the NSTIP provided a technoscientific road map for establishing a "'competitive national STI ecosystem' by 2025" that would serve the country's integration into the global economy—marked, most notably, by its admission into the World Trade Organization in 2005.[21]

The first phase (2008–2014) of the NSTIP, also known as Maarifah 1, was focused on nurturing innovation capacity in two kinds of strategic technologies: those in which the kingdom enjoyed competitive advantages (such as conventional and renewable energy and mineral extraction) and those that were prioritized on national security grounds (including genetics, aviation, robotics, nanotechnology, and space).[22] Among its more specific goals were expanding existing research and development (R&D) infrastructure and facilitating the localization and commercialization of targeted technologies.[23]

The NSTIP's first phase was allocated $2 billion.[24] This liquidity, in conjunction with the new mandate from the NSTIP, allowed KACST to expand its facilities, set up a more generous funding and grants system for local researchers, improve domestic access to global databases, and organize both national and international scientific gatherings, among many other initiatives.[25] Partnerships and exchanges with foreign institutions also noticeably increased during this time, such as with the European Organization for Nuclear Research.[26]

The NSTIP was an immediate beneficiary of the large-scale educational reforms undertaken by the kingdom in the 2000s. Saudi Arabia's overall ratio share of R&D workers was estimated to be at twenty-three per 100,000 of the population, a figure well below the average of 500 per 100,000 found in more advanced economies.[27] Higher education degree-holders in general were too few in number.[28] To solve this scarcity in human resources, the Saudi state spent some $320 billion on the educational sector from 2004 to 2013.[29] While nearly half of this expenditure was dedicated to rents, a portion of it was allocated to the quantitative and qualitative development of the sector.[30]

Between 2005 and 2015, the number of colleges and universities in Saudi Arabia (both public and private) doubled from seventeen to thirty-four, many of which established specialized research centers.[31] Among the most important legacies of this period was the King Abdullah University for Science and Technology (KAUST)—a private STEM-focused graduate-level research university located to the north of Jeddah.[32] Supported by a $20 billion endowment (from the Saudi state and Saudi Aramco) and equipped with some of the most advanced facilities and supercomputers in the Middle East, KAUST has quickly emerged since its founding in 2009 as a major regional scientific hub.[33]

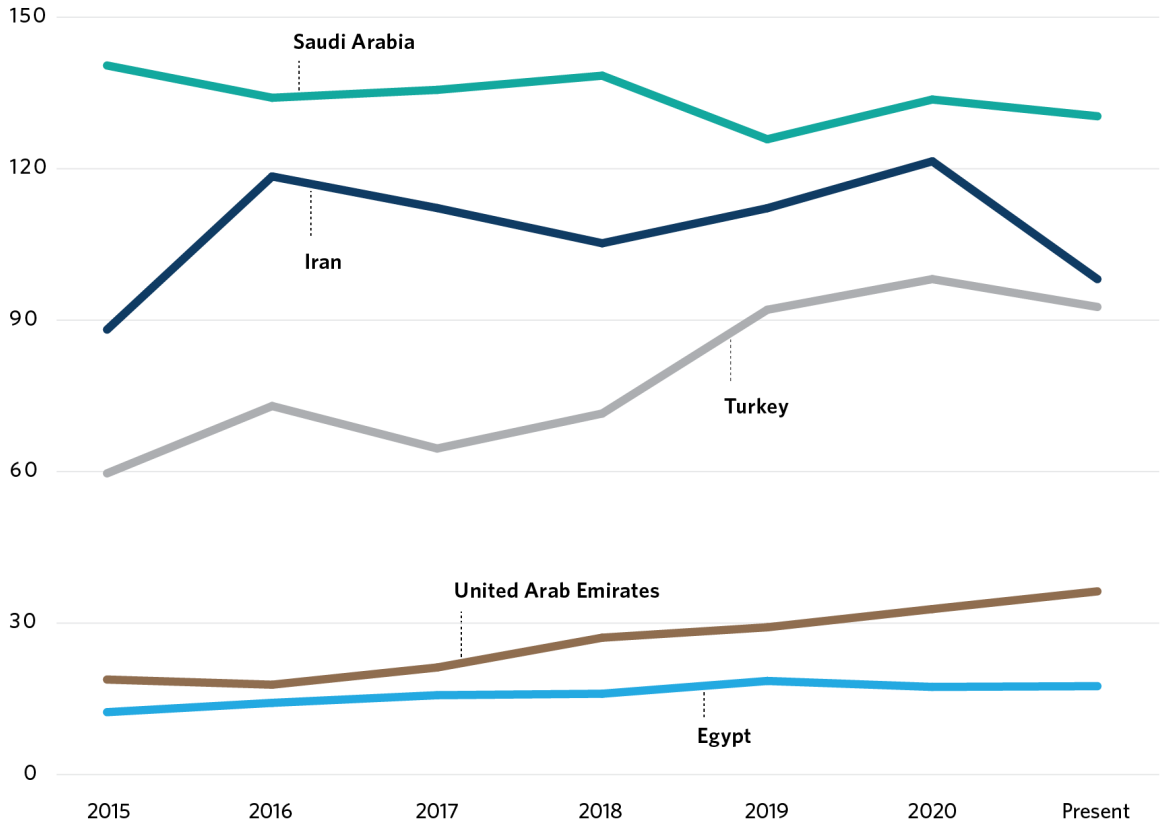
Recruitment drives of foreign faculty, administrators, and fellows were carried out as part of these reforms: KAUST's three presidents have been Shih Choon Fong, previously president of the National University of Singapore; Jean-Lou Chameau, previously president of the California Institute of Technology; and, currently, Tony Chan, the former president of Hong Kong University of Science and Technology.[34] This influx has had an internationalizing effect on the Saudi academic environment, overhauling research practices and giving rise to new forms of regional and international collaboration.[35]

An increasing number of overseas-educated Saudis likewise have returned to work at Saudi universities and laboratories.[36] Many of these graduates, like hundreds of thousands of Saudi citizens, were recipients of financial support from the King Abdullah Scholarship Program (renamed the Custodian of the Two Holy Mosques Program in 2022), which was launched in 2005.[37] In 2018, for instance, over 122,000 citizens benefited from the program, including 44,000 studying in STEM-related majors.[38] The United States was by far the most popular destination for scholarship recipients, accounting for 48 percent of the total in 2005–2015.[39]

All of these investments paid off in some tangible progress. The NSTIP aims for 2 percent of Saudi Arabia's gross domestic product (GDP) to be allocated to R&D by 2025.[40] Data from the UNESCO Institute for Statistics showed the percentage of Saudi GDP dedicated to R&D increasing from 0.05 percent in 2008 to 0.8 percent in 2013. (The *Eighth Development Plan* estimated expenditure at 0.3 percent of GDP in 2005.)[41] Although this upward trajectory was primarily driven by the public sector, the attention accorded to research by state-owned companies like Saudi Aramco, the Saudi Basic Industries Corporation (SABIC), and the mining giant Ma'aden probably played a contributing role.[42]

In tandem, the quantity of publications produced by Saudi academics in international peer-reviewed scientific journals, as well as that of registered patents both domestically and globally, increased.[43] Important milestones were reached: the King Faisal Specialist Hospital and Research Centre—which was awarded nearly a third of NSTIP grants during the first phase—launched a ten-year project to map and sequence the genome of the Saudi population.[44] Much of this progress was reflected in the Nature Index's global research rankings, where Saudi Arabia rose from thirty-ninth in 2012 to thirty-first in 2015, surpassing all other Arab states as well as Türkiye and Iran.[45] It continued to retain this dominant position for 2016–2021, although the gap with its regional non-Arab peers narrowed somewhat (see figure 1). Nevertheless, "Saudi Arabia leads the way in scientific research in the Arab world."[46] The slight decline—or stagnation—after 2015 was attributed by a KACST report to disruptions in funding that occurred with the conclusion of Maarifah 1.[47]

Figure 1: Saudi Arabia's Research Output Compared to That of Other Countries in the Middle East and North Africa



NOTE: "Research output," for this figure, is based on the number of publications in scientific journals.

SOURCE: Generated by Nature Index based on the authors' search. "Compare Countries/Territories," Nature Index, accessed July 8, 2022, https://www.nature.com/nature-index/country-territory-research-output?type=share&list=Saudi+Arabia%3BEgypt%3BUnited+Arab+Emirates%3BIran%3BTurkey.

This success, however, was not categorical. Although national research capacities improved, the relationship between research outputs and commercial or industrial applications was weak.[48] The Global Innovation Index, a yearly study conducted by the World Intellectual Property Organization, repeatedly identified the kingdom as performing "better in innovation inputs than innovation outputs."[49] In essence, Saudi Arabia remained a consumer, as opposed to a producer, of technology. There were attempts to address this problem under the NSTIP. In 2007, KACST launched the Badir Program as an incubator for high-tech companies.[50] The Saudi Technology Development and Investment Company (TAQNIA), a state-owned investment vehicle for the commercialization of technologies, was established by royal decree in 2011.[51] Universities founded science and technology parks, such as the Riyadh Techno Valley (under King Saud University), the Dhahran Techno Valley (under King Fahd University of Petroleum and Minerals), and the Makkah Techno Valley (under Umm

al-Qura University).[52] These initiatives have had a mixed record, succeeding in the commercialization of Saudi-patented technologies abroad but failing to cultivate a local start-up culture capable of reaping the benefits of the country's expanded research outputs.[53]

Vision 2030 has had a wide-ranging impact on the country's technoscientific trajectory. Through the National Transformation Plan (NTP),[54] which subsumed the NSTIP and its second phase—lasting 2015–2019 and known as Maarifah 2—the Saudi state fine-tuned its management of the domestic research ecosystem, shifting away from an emphasis on indiscriminately increasing outputs to translating innovation into more concrete economic dividends. Exploiting the commercial and industrial applications from locally generated research, substantially expanding "Saudi Made" content in manufactured products, and bringing about the "Fourth Industrial Revolution" have all become key goals in Vision 2030's technoscientific push.[55]

Technology has been accordingly reenvisioned as an accelerator for state-led industrialization and industrial upgrading.[56] This is discernible, for instance, in the defense sector, where KACST has not only expanded its programs for the development and production of satellites, unmanned aerial drones, robotics, and cybersecurity systems—all under the rubric of Saudi national security—but also actively cooperated with the General Authority for Military Industries (established in 2017), an entity that endeavors to ensure that at least 50 percent of Saudi military expenditure will be spent locally over the next decade.[57]

How has the kingdom's leadership set about realizing this technoindustrial strategy at the core of Vision 2030? First, the Saudi state implemented two sets of organizational reforms that have infused the bureaucracy with a strong sense of direction regarding what is to be achieved in the technoscientific sphere. One of these sets came from Vision 2030, which created a myriad of new technology-focused institutions with somewhat different but nevertheless overlapping mandates (a phenomenon not unheard of in the Saudi context).[58] Among these were the Saudi Federation for Cybersecurity, Programming and Drones (SAFCSP), established in 2017; the National Cybersecurity Authority, established in 2017; the Saudi Authority for Intellectual Property, established in 2018; the Saudi Data and AI Authority (SDAIA), established in 2019; the Digital Government Authority, established in 2021; and the Research, Development and Innovation Authority, established in 2021. In addition, older bodies such as the Ministry of Communications and Information Technology (MCIT) were bequeathed with newfound importance, resources, and powers.

As the Saudi state dotted the bureaucratic landscape with many new actors, it also sought to foster greater coordination among them. This was to be achieved by having these new entities answer to powerful centralized bodies, such as the Council of Economic and Development Affairs (CEDA), while simultaneously populating their boards (and those of other preexisting entities) with officials

from other institutions, thus guaranteeing some degree of interlocking, accountability, and cooperation. KACST's board—in one demonstrative example—was reshuffled in 2021 to include stakeholders from across the Saudi domestic research ecosystem, private sector, and government; the MCIT minister is now the board chairman.[59]

Second, and with a disciplined bureaucracy now well harnessed to sustain and expand upon the gains made in the technoscientific sphere, the Saudi state has actively worked to shepherd domestic and international capital to fund its technoindustrial strategy.[60] The most important actor by far in this process is the Public Investment Fund (PIF), a relatively old sovereign wealth fund (SWF) dating back to 1971, which the current Saudi leadership has resculpted into a powerful instrument of economic statecraft.[61] In 2015, oversight of the PIF was transferred from the Ministry of Finance to CEDA, providing it with considerable autonomy. In addition, the PIF came to amass substantial assets, ranging from foreign reserves obtained from the central bank to stakes in Saudi Aramco, the country's crown jewel.[62]

Assigned the task of accelerating the pace of technological acquisition and localization, with an eye toward cultivating high-tech industrial-scale sectors, the PIF founded (or assumed a major stake in) over seventy companies involved in strategic sectors of interest to the Saudi state.[63] Some of the most important with respect to the technoscientific sphere include Elm (established in 1988), TAQNIA (established in 2011), the Saudi Information Technology Company (established in 2017), the Saudi Arabian Military Industries (established in 2017), and NEOM (established in 2019).[64]

Concurrently, the PIF has positioned itself as a financial mover in relation to new and disruptive technologies worldwide.[65] In 2016, it partnered with the SoftBank Group to create the SoftBank Vision Fund as a vehicle for injecting capital into promising international start-ups, committing nearly $45 billion.[66] While risk and profit calculations inform PIF investments, the SWF operates with the expectation that its capital will result in training programs, knowledge- and technology-transfer arrangements, and even regional relocations of headquarters and manufacturing capacities for targeted firms.[67]

An illustrative example is Lucid Motors, an American electric-vehicle manufacturer: the PIF acquired a majority stake (over 60 percent) that has led to the company agreeing to open a plant in the King Abdullah Economic City (to the north of Jeddah) and provide a training program, based in California and Arizona, for Saudi nationals.[68] Similar arrangements have materialized with other tech giants such as CISCO, Apple, IBM, and Google.[69] The PIF is by no means the only actor in this story of entangled capital and technology: the MCIT, KACST, and Saudi Aramco—among many others—have been mobilized to create platforms, programs, and venture funds targeting promising technology companies.[70]

With all these domestic developments under Vision 2030, the Saudi state has been eager to underscore its new hypertechnological identity and showcase its state-led achievements in the technoscientific sphere. Inaugurated in 2017, and notwithstanding its rough beginnings, the Future Investment Initiative has become a major annual forum attracting bankers, investors, and technologists to Riyadh.[71] At the same time, the kingdom has actively hosted hundreds of technology-related events, such as LEAP, an annual exhibition first launched in 2022 and cohosted by MCIT and SAFCSP.[72]

Saudi Arabia has likewise sought to depict itself as leader in the international technoscientific landscape, and one capable of generating standards and norms. To that end, the kingdom founded the Digital Cooperation Organization (DCO), based in Riyadh, to coordinate digital and technological cooperation across the Global South.[73] On the sidelines of the Global AI Summit, hosted by the SDAIA, the DCO endorsed the Riyadh AI Call for Action Declaration.[74]

Nor has the Saudi state been negligent in expanding its footprint in existing global organizations. In 2020, the kingdom applied for and gained membership in the UN Commission on Science and Technology for Development; two years later, it was elected to chair the twenty-fifth session.[75] KACST also joined the governing board of the Global Research Council.[76]

Chinese-Saudi Technoscientific Cooperation

Prior to 1990, when Saudi Arabia normalized its diplomatic relations with the PRC, most of its international technoscientific collaboration in East Asia was with research institutions based in Taiwan.[77] Although an agreement was signed in 1996 between KACST and China's State Scientific and Technological Commission (renamed the Ministry of Science and Technology in 1998), it was only in the mid-2000s, with the momentum created by the kingdom's "eastward policy" (*siyasat al-istishraq*) toward Asia, that the tempo of technoscientific exchange quickened.[78] KACST signed a memorandum with CAS that led to a series of genome-mapping projects and the establishment of a Joint Center for Genomic Research in Riyadh.[79] KACST also entered into agreements with other Chinese state partners concerning nuclear power generation (in 2013) and space exploration (in 2014).[80] In parallel with these developments, the energy giant Saudi Aramco and the petrochemical giant SABIC, seeking to consolidate their growing footholds in the Chinese market, also opened research and technology offices in Beijing (in 2015) and Shanghai (in 2013), respectively.[81]

Formalized technoscientific cooperation between China and Saudi Arabia then went into overdrive in the mid-2010s. This was particularly noticeable in the aftermath of President Xi Jinping's visit to Saudi Arabia and Crown Prince Mohammed bin Salman's reciprocal visit to China, both in 2016. The High-Level Coordination Committee, created that same year to strengthen bilateral relations,

contained six subcommittees, one of which was focused on accelerating and expanding bilateral technological exchange.[82] The MCIT simultaneously signed an agreement with China's National Development and Reform Commission (tied to the State Council) to foster more engagement, through dialogic synergy between China's Digital Silk Road Initiative (DSRI) and the kingdom's Vision 2030, in technologies related to smart city and smart energy grid management, digital infrastructure such as fiber optics, and e-governance.[83]

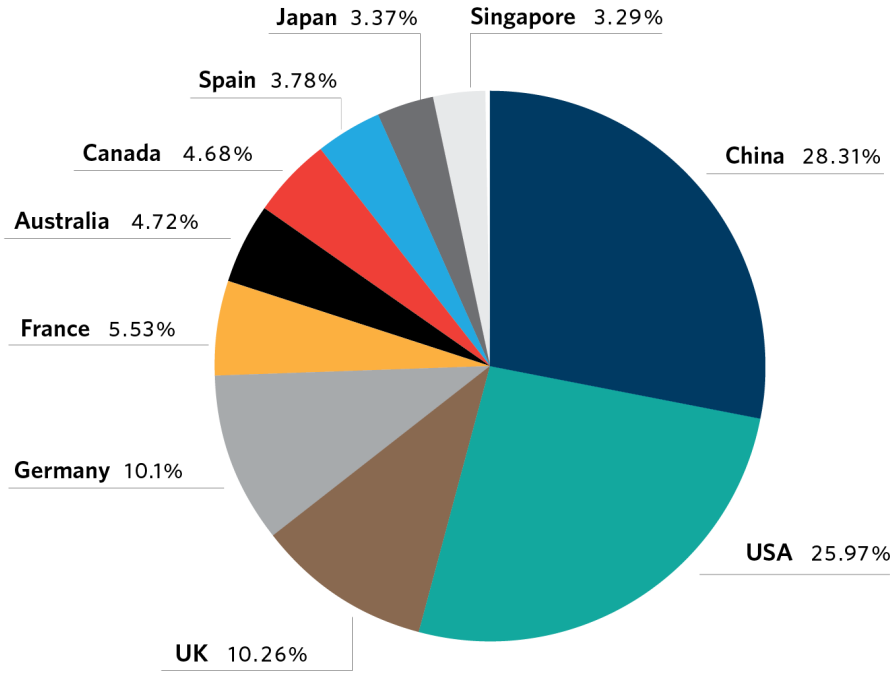
These new cooperation and institutional partnership frameworks set the stage for companies such as Huawei, which became a major player in the deployment of 5G networks across the Saudi market (through carriers including Saudi Telecom Company, Mobily, and Zain) in the late 2010s, to assume a greater role in providing digital training and accreditation for Saudi citizens, whether via their own internal programs or in partnership with newly formed institutions like the MCIT-backed Saudi Digital Academy.[84]

Saudi agency has been critical to this entire trajectory. Technoscientific cooperation between the two countries has been centered around the imperatives of *localization*: technology-sharing, industrial and research capacity buildup, and human resource development. This localization impulse, driven by Vision 2030, has in turn enjoyed a boost from newfound energy in forging partnerships with China. For example, in 2016, KACST concluded a memorandum with the China Satellite Navigation Office regarding cooperation on satellite manufacturing, the usage of the BeiDou Satellite Navigation System, and the "establishment of a permanent space station" for Saudi Arabia.[85] Under this agreement, KACST was able to produce and test various components for satellite manufacturing with relevant Chinese counterparts, including an experimental optical camera that was utilized in the Chang'e-4 lunar mission.[86] TAQNIA, through its various subsidiaries, is also engaging Chinese firms to "support the strategic space and geospatial industry in Saudi Arabia."[87]

Beyond space-related technologies, KACST has also sought out partnerships with Chinese state-owned firms to acquire more sophisticated unmanned aerial vehicle (UAV) models exceeding the capacities of its own domestically produced Saqr series.[88] With the assistance of TAQNIA, KACST has moved to set up manufacturing facilities for CH-4 reconnaissance drones with the China Aerospace Science and Technology Corporation.[89] In recent years, other Saudi actors, such as the PIF-linked Advanced Communications and Electronic Systems Company, have entered into joint ventures with Chinese counterparts for UAV production.[90] As per the agreements, many of these UAV facilities will carry out production in Saudi Arabia itself.

As these proliferating projects would indicate, and as correctly argued by Sun Degang and Wu Tongyu, the kingdom has forged one of the most technoscientifically expansive relationships with China in the Arab world, effectively touching upon all areas of technoscientific interest identified in the *Arab Policy Paper* issued in 2016.[91] These developments are buttressed by research-centric institution-based cooperation: since 2013, as one study shows, there has been a steady quantitative increase in jointly written Chinese-Saudi scientific publications.[92] Moreover, according to the Nature Index, China's share of Saudi Arabia's total international research collaborations grew to 28.3 percent by 2022–2023 (see figure 2), exceeding that of the United States (26 percent), Germany (10.1 percent), and the United Kingdom (10.3 percent).[93]

Figure 2: Breakdown of Saudi International Collaborations



SOURCE: "Saudi Arabia," Nature Index, accessed July 23, 2023, https://www.nature.com/nature-index/country-outputs/Saudi%20Arabia.

In short, the PRC's expanding presence within Saudi Arabia's technoscientific landscape has had a strong localization component that Saudi actors themselves have driven and shaped. There are three features or dimensions that need to be considered, however, when thinking about how localization is unfolding, and what types of cooperation are being prioritized as a result: human resources, capital, and the role of the state.

The Question of Human Resources

Human resource linkages between Saudi Arabia and the PRC in the technoscientific sphere are shallow—complicating cooperation, at least in the short and medium term. Since the mid-2000s, and enabled by the opening of a Saudi cultural attaché office in Beijing in 2009, a few thousand Saudis have benefited either from the national scholarship program or from training courses arranged by major companies like Saudi Aramco.[94] A minority have procured STEM-related degrees, but their numbers are insufficient to change the existing composition of the Saudi scientific community, the majority of whom were trained in Western institutions.

It is unclear how many Saudis have participated in the Outstanding Young Scientist Coming to China Working Project (*jiechu qingnian kexuejia laihua gongzuo jihua*) run by the PRC's Ministry of Science and Technology, but the number is likely small.[95] It is doubtful that this overall situation will change over the next decade or so. Long-term projections released by the cultural attaché office indicate that it does not expect the total number of Saudis studying in China to exceed three thousand by the end of the decade—a paltry figure in comparison to the tens of thousands studying in the United States at any given time.[96] The same report fixed the goal rates of enrollment breakdown in 2030 for the Saudi overseas student population at 60 percent for the United States, in contrast to 5 percent for the PRC (the same percentage as Germany, Japan, the Netherlands, and South Korea; see table 1).[97]

Table 1: Targeted Breakdown of Saudi Overseas Student Population in Various Countries by 2030

Country	Percentage of Scholarships	Country	Percentage of Scholarships
USA	60%	Netherlands	5%
Britain	10%	Malaysia	1%
Germany	5%	India	1%
Japan	5%	Italy	1%
China	5%	Singapore	1%
South Korea	5%	Russia	1%

SOURCE: "Masarat al-barnamaj fi al-marhala al-rabi'a [Trajectories of the Program in the Fourth Stage]," Saudi Arabia Cultural Mission in Beijing, 4.

If the linkages between Saudi scientists and Chinese institutions are so thin, what explains China's considerable research collaboration with the kingdom? A scrutinizing look at the Nature Index reveals that a significant portion of these interactions occurs through one institution: KAUST.[98] This is in many ways unsurprising. With two ethnically Chinese presidents and an active outreach and recruitment program targeting mainland China, Hong Kong, Taiwan, and Singapore, KAUST has attracted hundreds of Chinese students and faculty members over the past decade.[99] PRC citizens make up the largest demographic of non-Saudi alumni, and many graduates have gone on to join mainland institutions.[100] These personal links have allowed KAUST to develop joint research projects with entities including CAS, Tsinghua University, China University of Petroleum (Beijing), Soochow University, Southern University of Science and Technology, and the University of Science and Technology of China.[101] This also explains how KAUST became a recipient of funding from the National Natural Science Foundation of China and the 973 Program.[102]

Notwithstanding the exceptional case of KAUST, the problem of limited human resources not only restricts the scope of research cooperation but can also potentially hinder the operations of Chinese technology companies entering the kingdom in solo or joint-venture capacities. Almost all of them must contend with an inevitable Saudization mandate (requiring that a certain percentage of their employees be Saudi nationals) and deal with a labor market defined by talent scarcity. This may explain why the MCIT has actively worked with ZTE and Huawei in setting up training and vocational programs for thousands of Saudi nationals over the past few years.[103] It should be noted that the Saudi state, though animated by the overriding objective of decreasing unemployment among Saudi nationals, has some options to mitigate this issue, such as extending a temporary (or delayed) waiver on Saudization requirements for Chinese companies, among others.

It is unclear whether such efforts will be sufficient, as even Mandarin-proficient Saudi graduates from Chinese universities have reported—anecdotally—difficulties in adapting to the work culture of Chinese corporations, at least back in the mid-2010s.[104] At the same time, one should not discount that there are generational shifts taking place in both Saudi Arabia and the PRC; people, and the companies they oversee, are malleable and adaptable. Past experiences might not illuminate much about the capabilities and receptivity of those trained under these new programs.

In all, the limitations in human resources will definitively shape the contours of localization for some time to come, creating a strong impetus for finding bilateral solutions aimed at expanding the local pool of talent capable of engaging and working with Chinese research and corporate entities. The general tendency, as outlined by Vision 2030, is the gradual empowerment of Saudi nationals in all technoscientific spheres, including those involving Chinese actors.

The Question of Capital

Capital circulations between Saudi Arabia and China in the technoscientific sphere remain somewhat limited but show signs of promising growth that will be largely propelled by the Saudi state itself. Bilateral investment between the two sides has steadily increased over the years, although much of this capital flow has been concentrated in construction and industrial projects.[105] More recently, there are clear signs of sustained efforts to court and redirect capital into technology ventures, as these have become a much higher priority for the Saudi state.

For example, the annual gatherings of the Future Investment Initiative include a growing stream of corporate and official figures from the PRC and Hong Kong in their rosters, suggestive in turn of nascent but expanding entrepreneurial, banking, and investment connections between East Asia and the Gulf.[106] In 2023, the second LEAP event saw the inauguration of a Saudi Arabia–China Entrepreneur Association (run by eWTP Arabia Capital), with the backing of the MCIT and SAFCSP, again indicative of targeted efforts to consolidate investor-level relationships at the technoscientific level.[107]

Unsurprisingly, the PIF is the primary motor behind the redirection of capital. Though its leadership—most notably Governor Yasir al-Rumayyan—continues to openly express the view that the United States is where disruptive innovation is taking place and is thus a priority for PIF engagement, the Chinese technology landscape is of mounting strategic interest to the PIF.[108] Over the past few years, the PIF has leveraged the SoftBank Vision Fund and eWTP Arabia Capital (established in 2019 and supported by Chinese companies Alibaba Group and Ant Group) to invest in Chinese companies and even bring them to the kingdom.[109]

The China International Capital Corporation (CICC), a partially state-controlled major joint-venture investment bank, recently opened a new head office for West Asia in Riyadh with an implicit mandate from the Chinese central government to facilitate, through coordination and dialogue with the PIF, the entry of major players in the PRC technology market into Saudi Arabia.[110] Delegations are brought, introductions are made, and business proposals are presented in this process of exchange, with the ultimate decisionmaking in the hands of the PIF.[111]

More significantly, the PIF submitted an application in late 2021 for Qualified Foreign Institutional Investor (QFII) status in the PRC.[112] Initiated in 2003, the QFII program allows foreign actors to directly invest into the Chinese stock market using renminbi, albeit within a fixed yearly quota. Considering Xi's call during his December 2022 state visit to Saudi Arabia for oil to be sold in renminbi, the PIF's obtainment of QFII status will likely reduce misgivings about such a denominational shift, as it means that accumulated yuan reserves could be recycled through PIF investments into China.[113] QFII status would allow the PIF to interact with Chinese technology companies on a far larger scale than it had previously—and the PIF's application has reportedly been approved.[114]

As capital ultimately emanates—at least in this stage—from Saudi actors, the latter's technology localization needs will be prioritized. This has been reinforced by the positive momentum in Chinese-Saudi relations, creating an impetus for the central government to encourage Chinese technology companies to engage and interact with their moneyed counterparts in the kingdom. Improvements to the domestic business environment might alter this dynamic somewhat and allow for greater involvement of private sector investors from both countries in the future, but this will take time to come to fruition.

The Question of the State

Considering some of the issues presented by human resources and capital circulation, and in light of the expanding ambitions of the Saudi state itself, the world can expect that Chinese-Saudi technoscientific cooperation will be state-driven and centered around technology localization for much of the foreseeable future. In making this point, the authors constructed and analyzed a novel panel database of twenty joint technoscientific projects launched between 2007 and 2021.[115] The twenty projects analyzed came from twenty technoscientific fields, listed below:

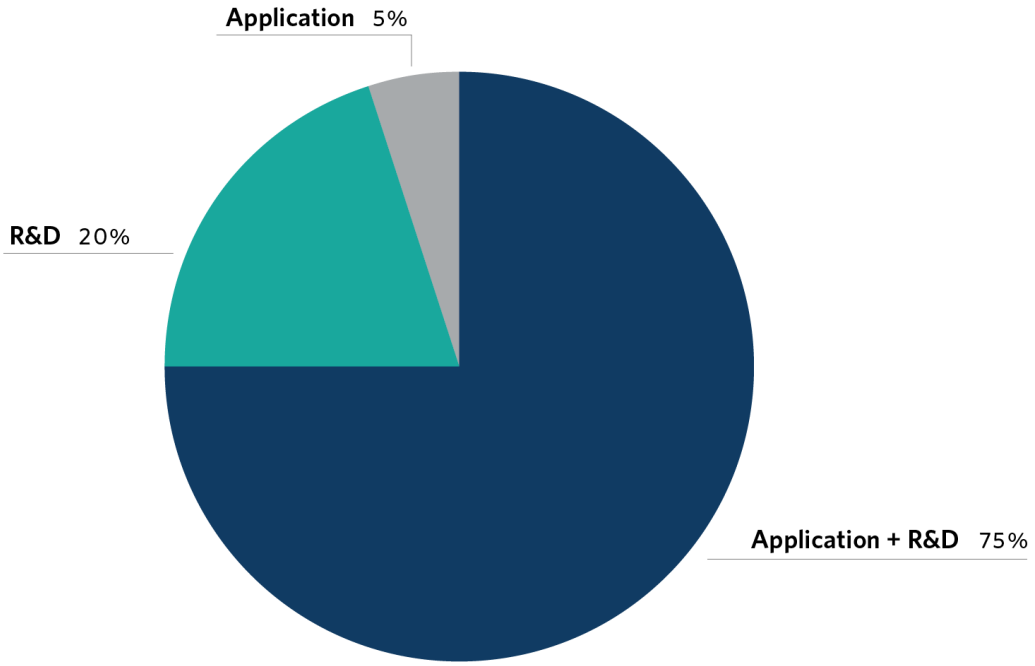
- Electronics
- Smart city (digital governance)
- Internet of things
- Manufacturing tech (including environmentally and socially responsible industrialization and intersections with artificial intelligence)
- Drones
- Satellite system R&D
- New infrastructure (telecommunications and renewable energy)
- 5G hardware and software
- Cloud services and computing
- Hardware and software for high-speed railways
- New materials and material science (manufacturing and R&D)
- E-commerce applications and software R&D
- Renewable energy (solar and wind)
- Photovoltaic manufacturing
- Health technology (genetics and biopharmaceuticals)
- Artificial intelligence applications and R&D
- Electric vehicles (batteries and supply chains)
- Nanotechnology
- E-games and new entertainment
- Data services

Over 75 percent of these projects were initiated post-2017, following the major turning point in Chinese-Saudi relations in 2016. Additionally, 60 percent of the projects were undertaken by Chinese state-owned enterprises, such as the China National Petroleum Corporation, the China National Nuclear Corporation, and the China Aerospace Science and Technology Corporation. The remaining 40 percent were carried out by national champion firms from the private sector, such as Huawei, Alibaba, and Tencent. This breakdown in percentages indicates that Chinese-Saudi technoscientific cooperation is largely state-driven.

This was implicitly criticized by former MCIT minister (and former head of KACST) Muhammad al-Suwaiyel in an interview with CGTN Arabic, wherein he stated that there was a need for more direct interactions between the Saudi and Chinese private sectors, and that bilateral agreements needed to move beyond generalities toward discussing more concrete areas of cooperation.[116]

With respect to the question of technological localization, these twenty projects were evaluated based on key terms drawn from their development plans, project outlines, and industrial strategy reports with an eye to understanding two critical aspects. The first of these revolves around whether a given project was focused on application (manufacturing, production, accessibility, etc.) or R&D (research collaboration, supply chain innovation, etc.). Many projects tackled both application and R&D. Figure 3 shows that 5 percent of the projects were mainly on the application side, 20 percent on the R&D side, and the remaining 75 percent were a mix. The vast majority of the projects (95 percent) had at least an R&D component—a salient feature of technological localization and a pattern consistent with Chinese technoscientific cooperation with other nations.[117]

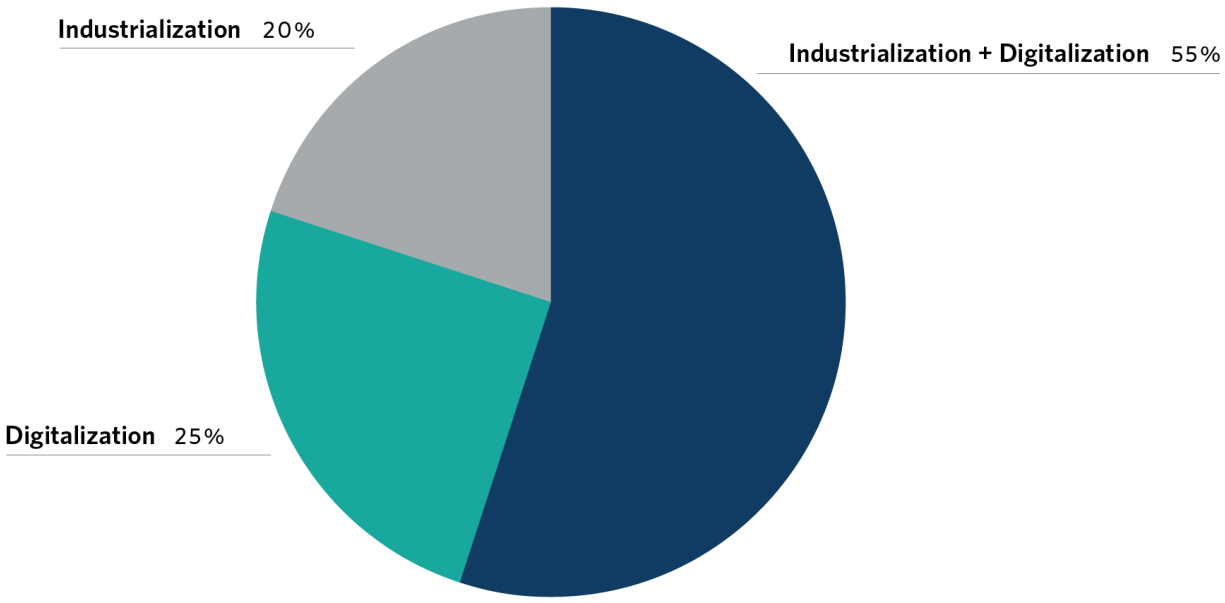
Figure 3: Application and R&D Distribution in Chinese-Saudi Technoscientific Projects



The second criterion evaluated in this study relates to the developmental nature of the projects. If a project's content indicated it was largely focused on manufacturing and industrial production without a clear and extensive usage of digital technology or innovative features, then it was categorized as industrialization. Likewise, if digital terms such as "internet," "intelligent," "data," and "cloud service" dominated the project description, that project was labeled as digitalization. Most projects were a mix of the two. As shown in figure 4, 20 percent of the projects could be categorized as industrialization, 25 percent as digitalization, and 55 percent as a combination of both. This suggests that both Saudi Arabia and China increasingly view industrial upgrading as necessitating the incorporation of digital interfaces and platforms—an approach that is reflected in the kingdom's technoindustrial strategy.

It is worth noting that many of the Chinese companies engaged in industrialization- and digitalization-related projects have had indirect positive spillovers into the local economy. These enterprises have responded positively to the call to use more "Saudi Made" items, reporting procurement rates from local sources exceeding 90 percent.[118] Some have even cultivated and trained local suppliers from scratch, improving domestic Saudi supply chains.[119]

Figure 4: Industrialization and Digitalization in Chinese-Saudi Technoscientific Projects



Takeaways and Lessons Learned

The Saudi state, over the course of half a century, has sought to achieve mastery in the technoscientific realm. This determination has only intensified under Vision 2030 and associated technoindustrial strategy. Within this overall framework, the kingdom has cultivated a dynamic technoscientific relationship with the PRC. But as this paper has shown, this dynamic synergy has not come about through China attempting to exercise greater influence through the soft underbelly of technology or through the Saudi leadership "leaning on one side" (*yibian dao*) of a new technological Cold War; rather, the partnership was born from the technoscientific and developmental needs of the Saudi state itself.

Though the PRC has proven itself to be a dependable catalyst for technological localization (even for sensitive technologies, such as long-range ballistic missiles and UAVs, that the United States and other traditional partners of the kingdom have at times been reluctant to share), there are real weaknesses that undermine this cooperation.[120] As indicated by the limitations in human resource linkages and capital flows, Saudi elites—including politicians, state investors, and scientists—persist in viewing the West as the standard of innovation and the true origin of most upcoming disruptive and cutting-edge technologies. This perception points to an important takeaway: China is but one actor drawn into Saudi Arabia's state-driven technoscientific transformation.

Western and non-Western countries besides China remain widely involved in the process of providing pivotal technoscientific resources for the kingdom. This is discernible in nearly all domains of technoscientific import. Agreements on e-government and digital infrastructure, akin to the DSRI, have been concluded with Russia (in 2017), Japan (in 2019), and South Korea (in 2019).[121] The kingdom also has an ongoing, expansive technoscientific protocol agreement with the United States (in force since 2008 and renewed for another ten years in 2021).[122] Saudi universities and research institutions likewise continue to exhibit a strong preference for working with Western (North American, European, and Australasian) counterparts, partnering with Western institutions in a cumulative 61.2 percent of the country's international collaborations.[123] A demonstrative example is KACST's Technology Leaders Program: though aiming to foster long-term training-oriented partnerships with prestigious institutions from around the world, it does not count a single Chinese university or research center among its partners.[124]

While acknowledging the multilateral scope of the Saudi state's technoscientific ambitions, it is worth emphasizing that cooperation with the PRC has resulted in tangible benefits related to technological localization. How can this success be explained? To put it simply, the strength of the Saudi state—the clarity of its national priorities, its expanding institutional capacity, its significant capital liquidity, and its positive relationship with the PRC—have enabled this. This argument somewhat

echoes the work of Ching Kwan Lee in *The Specter of Global China*. In interrogating the differences between Chinese capital and global private capital in Zambia's mining and construction sectors, she finds that the strength of the local state, and the importance it accords to any given sector, impacts its role in deciding its developmental trajectory and in prying compromises from foreign actors (investors in this instance), including those from the PRC.

Another relevant insight from Lee is that she considers Chinese capital (and its associated corporate culture) to be animated not solely by the search for profit but also by the political and diplomatic imperatives of the PRC. This is clearly at play in Saudi Arabia, and perhaps even more so considering that much of the capital being utilized is *Saudi* capital, which lubricates the process and lowers the costs of realizing these imperatives for the Chinese state itself. Thus, Chinese activities in the techno-scientific sphere are ultimately being directed to serve the explicit needs of the Saudi state—which can dictate the terms, after all—but are also taking cues from a Chinese state that seeks to build a strategic relationship with the kingdom.

Given the resources at the disposal of the Saudi state (managing a G20 economy in its own right) and its ambitions, this process of localization for Chinese technologies might be considered an exceptional one when compared with other environments. This is a uniquely Saudi story and one that necessitates greater attention if the full contours of the transformative changes taking place within the kingdom are to be appreciated and better understood.

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