

China's Model of Innovation

Are there Lessons for African Countries?

Peter Grinsted and Ovigwe Eugene

This note was commissioned by CGD with authors from Development Reimagined. The Center for Global Development is grateful for contributions from the UK Foreign, Commonwealth and Development Office, the Ford Foundation, and CGD's Board of Directors in support of this work.

CONTENTS

1. Introduction	3
2. The context and trends	3
Diverging IP and development paths in China and African countries	3
The importance of innovation	4
The economic rationale of intellectual property—an ongoing debate	7
The current status of innovation and IP rights protection across Africa and in China	11
3. What is the China model of innovation and IPR?	15
The model: Innovation with Chinese characteristics	15
Strong policy support for the introduction of foreign technologies	16
Late introduction of IP laws relative to level of economic development	18
Late accession to the WTO	19
IP and innovation openness	21
Quick adaptation to and adoption of new technologies, with the pace of innovation outpacing IP registration and implementation or enforcement	21
Experimental (and often competitive) policymaking	23
Huge domestic market and economies of scale	23
High spending and investment on R&D and human capital	23
4. How relevant is the China innovation model to African countries?	23
What makes China’s experience applicable to African countries?	24
What makes China’s experience NOT applicable to African countries?	28
Applicability of each highlighted feature of the Chinese innovation model in Africa	29
5. Conclusions and recommendations	31
Recommendations for relevant international and African organizations, including WTO and African regional bodies	32
Recommendations for African governments looking to support innovation development	33
Recommendations for China and other development partners looking to support innovation development in Africa	34
Endnotes.....	35

1. INTRODUCTION

Innovation is known to be important for productivity and economic growth, while intellectual property rights are, in conventional economics models, thought to spur innovation. Yet China, which averaged over 6 percent annual economic growth for three decades and is often cited as a “growth miracle,” has been criticized for poor intellectual property rights protection domestically, as well as when exporting products abroad. In Africa, headlines have appeared denouncing cheap copies or fake products from China and their adverse impacts on local manufacturing and other outcomes. Today, the Chinese government and private sector actors feel strongly that China is a global centre of innovation. Has China’s model of innovation been different to what conventional economic theory suggests? And could a similar model be relevant or appropriate in African and other developing countries?

This paper aims to answer three questions:

1. What is the relationship between innovation, intellectual property (IP), and economic growth? Do patent and other IP right protections lead to innovation and growth?
2. What led to China’s vast increase in innovation? What is the Chinese model? Did China’s late accession to the World Trade Organization play a role?
3. What lessons could African countries learn from China’s model?

The paper then draws on the results to make suggestions for innovation development across African countries.

2. THE CONTEXT AND TRENDS

Diverging IP and development paths in China and African countries

In 1999, China filed 276 patent applications via the World Intellectual Property Office’s (WIPO) Patent Cooperation Treaty (PCT) System. In 2019, China surpassed the United States as the source of the highest number of international patent applications at 58,990, equivalent to 20 percent of the global total, and a 200-fold increase over two decades.ⁱ The equivalent 2019 figure for Africa’s three largest economies—Nigeria, South Africa, and Egypt—*combined* is 326, with regional power Nigeria filing just one patent application.ⁱⁱ As shown in Figure 1, no applications were made in most African countries via the PCT system in 2019.

The divergence in IP trajectories between African countries and China is clearly shown in Figure 2. Since 1997, the growth in China’s total granted patents (including both direct and PCT national phase entries)¹ is steep compared to the relatively stable continental figure for Africa as a whole.

Alongside China’s rapid growth in patent applications has been a rapid growth in GDP and poverty reduction. World Bank data show that in 1990, China’s GDP per capita (at purchasing power parity)

¹ The PCT National Phase Entry is an application filed for obtaining a grant of patents in different countries simultaneously based on a single International/PCT application that is filed within 12 months from the priority date (or filed directly).

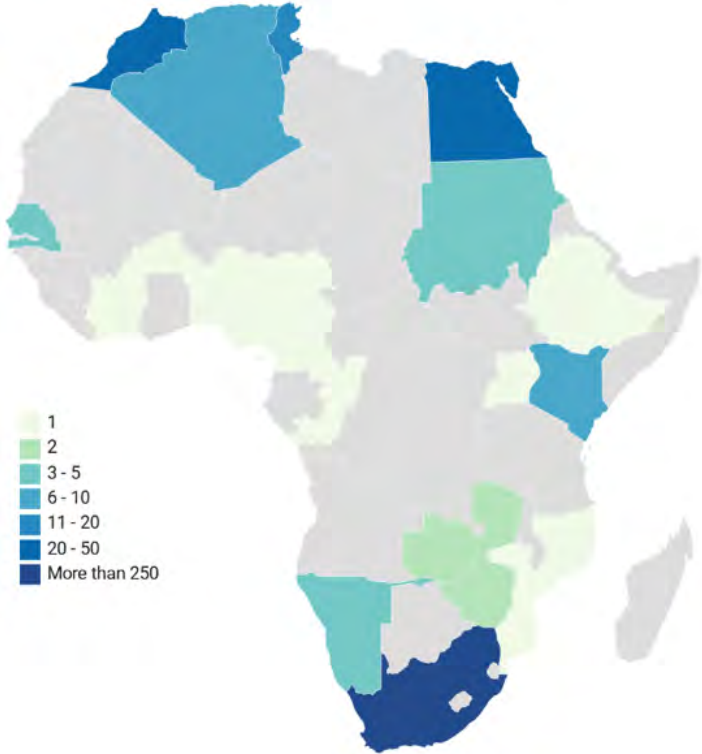
was lower than that of sub-Saharan Africa (SSA²); by 2018, China's GDP per capita was over six times the figure for SSA, as shown in Figure 3.

Adjusting to show the number of patents applied for by GDP per capita (at PPP), as shown in Figure 4, further shows this divergence. GDP per capita does not explain the difference; when accounting for changes in GDP per capita, China has shown great growth in patent applications, while in Africa patent applications have stagnated.

The importance of innovation

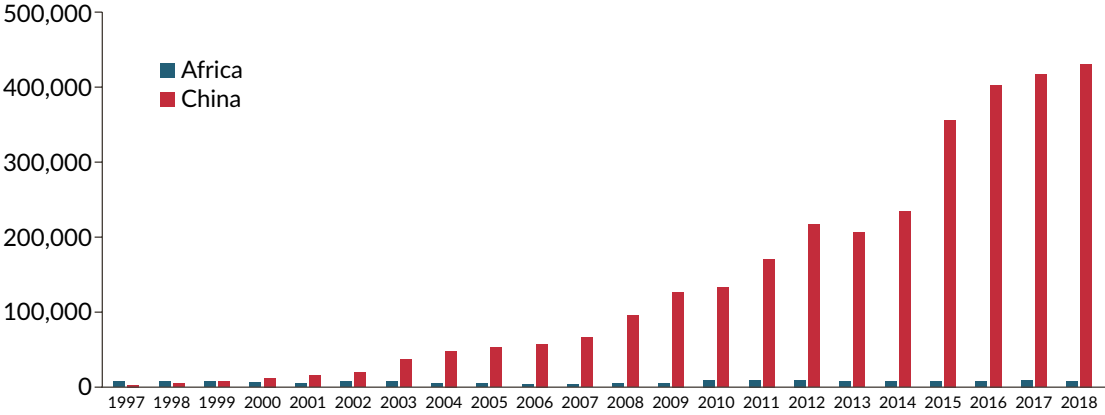
Innovation (defined in Box 1) is thought to be central to economic development. This is recognised by numerous organizations, including the United Nations and the African Union, in their respective goals and strategies. As innovation can happen in any sector, it is fair to say

Figure 1. Number of PCT applications per country 2019



Source: WIPO statistics database. Last updated: April 2020

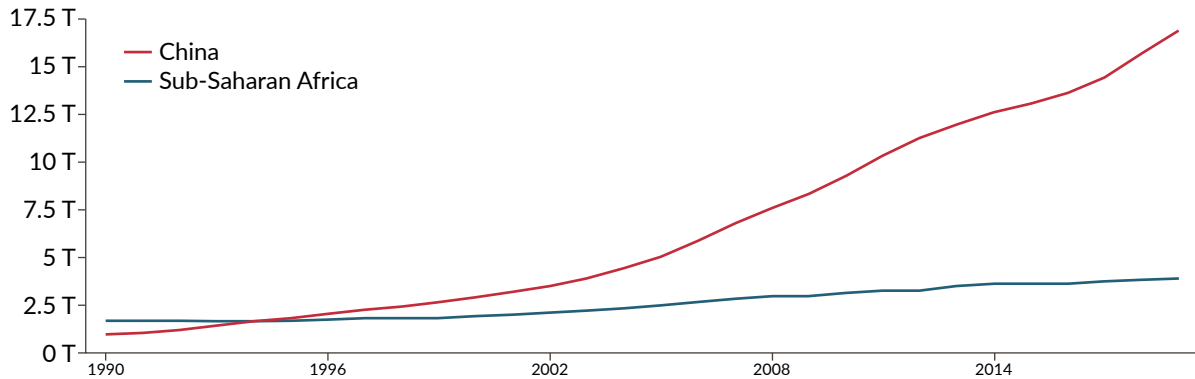
Figure 2. Total patent grants (direct and PCT national phase entries), 1997-2018



Source: WIPO statistics database. Last updated: April 2020

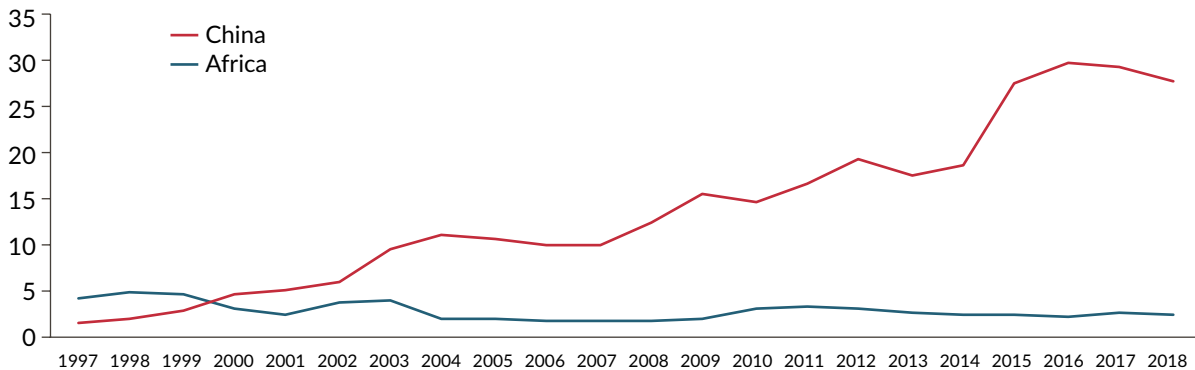
2 Data for sub-Saharan Africa is used rather than Africa as a whole as this is how the data was collated by the source

Figure 3. GDP per capita, PPP (current international \$)



Source: World Bank Development Indicators, <https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.PCAP.PP.CD&country=CHN,SSF>

Figure 4. GDP per capita (PPP) adjusted patent applications per year



Source: WIPO statistics database (Last updated: April 2020), and <https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.PCAP.PP.CD&country=CHN,SSF#>

that it can support the achievement of most development goals, though there are development targets specific to innovation:

- **Sustainable Development Goal 9 (SDG9)ⁱⁱⁱ—Industry, innovation and infrastructure.** SDG9 explicitly states a target to “foster innovation,” and sub-goal 9b places an emphasis on the importance of this in developing countries: “Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.”
- **Science, Technology and Innovation Strategy for Africa 2015–2024.^{iv}** As part of the AU’s Agenda 2063,^v this document puts “innovation at the epicentre of Africa’s socio-economic development and growth.”

Box 1. Innovation

Defining innovation is not as simple a task as one might think.^{avi} In economics, innovation usually describes the development and application of ideas and technologies that improve goods and services or make their production more efficient.

The typography of innovation is also varied, including the following:

- Product, process, and business model innovation.
- Product, service, process, management, and open innovation.
- Incremental, disruptive, architectural, and radical innovation.

This briefing focuses on the types of innovation that can be patented.³ **This can be any of the four types of innovation listed but in particular the third bullet point.** It can also, however, include service, process, management, open and business model innovation, if said innovation can be patented through a device or technology being directly involved.

Intellectual property that is protected by other means, such as trademarks and geographical indications, are not the focus of this note since they are less “directly” related to the typography of innovation set out above than patent applications (although they of course do involve innovation to some degree).⁴

Why and how is innovation important for economic growth?

At a fundamental level, there are only two ways of increasing the output of the economy: by increasing the number of inputs in the productive process, or by developing new ways to get more output from the same number of inputs through innovation. In the 1950s, analysis showed that measured growth in inputs (both capital and labour) in post-Civil War US (1870–1950) could only account for around 15 percent of the actual growth in the output of the economy.^{vii} This left an unexplained residual of 85 percent, which persuaded academia that innovation (often through technology) must have been a major force for growth.^{viii}

Other economists studying growth accounting, including Nobel Laureate Robert Solow, also found broadly similar unexplained residuals, despite using different methodologies, time periods of study, and geographies. Indeed, several studies have shown a positive relationship between innovation and economic growth, in a variety of countries and regions, including both high- and low-income countries.^{ix}

In summary, countries that show more evidence of innovation are richer and grow faster.^x Incentivizing and developing innovation has therefore become a key goal of many governments and organizations.

3 Although patents are an imperfect measure of innovation, especially in places like Africa, where few people register their IP, and patents are (especially relative to local incomes) expensive, they nevertheless remain a useful measure (see Abiodun Egbetokun, Richmond Atta-Ankomah, Oluseye Jegede & Edward Lorenz (2016) Firm-level innovation in Africa: overcoming limits and constraints, *Innovation and Development*, 6:2, 161–174, DOI: 10.1080/2157930X.2016.1224619)

4 For more on the status and potential of geographical indications in Africa, please see <https://developmentreimagined.com/2020/01/24/geographical-indications/>

The economic rationale of intellectual property—an ongoing debate

The positive relationship between innovation and economic growth is clear—but where does intellectual property (IP) come into this? Does IP, and stricter IP rights (IPR) protection, lead to innovation and growth? The general understanding of the relationship between IPR and development has changed significantly in recent years, in no small part because of China's experience.

For decades, international IP discourse was influenced by the belief that innovation and economic development requires or benefits from strong IP protection, and that IP protection invariably leads to development. In the words of Dr. Kamil Idris, a former WIPO director-general, IP is “a power tool for economic growth.”^{xi} A basis for this theory, a 1962 article by Nobel Laureate Kenneth Arrow, is summarized in Box 2.

Box 2. Arrow's 1962 work

In 1962, American economist Kenneth Arrow (1921–2017) famously introduced a theory that became the bedrock and basis for intellectual property rights.

To quote Arrow: “[T]here is a fundamental paradox in the determination of demand for information; its value for the purchaser is not known until he knows the information, but then he has in effect acquired it without cost.” (1962, p. 615)

In simple terms, Arrow argued that an information paradox arises when two parties are trying to exchange information. He argued that to complete such a transaction, the buyer of the information must be able to place a value on the information and can only do so through the disclosure of the information by the seller. But once the seller discloses this information, the value is lost as the buyer can use it without paying. Hence, Arrow argued, there is no demand for information.

Intellectual property rights (such as patents) can solve this paradox by removing the disincentive to disclose information. If the seller knows its information is protected, it can freely share it, in the knowledge that the buyer can be prevented from using the information without the seller's permission. That is, protection cannot be given to an undisclosed invention, but it is assumed that a patent officer will not use or distribute it (unlike a potential buyer would) before granting the patent, which then allows the inventor to appropriate the social value of their information (or innovation/invention).

Arrow argued that a monopolist's incentive to innovate is less than that of a competitive firm, due to the monopolist's financial interest in the status quo. This fundamental idea comports with common sense: a firm earning substantial profits has an interest in protecting the status quo and is thus less likely to be the instigator of disruptive new technology. In Arrow's words: “The pre-invention monopoly power acts as a strong dis-incentive to further innovation.”

Criticisms of this theory, and the assumptions inherent to it, are discussed further in the main section.

Source: Arrow, Kenneth Joseph. “Economic welfare and the allocation of resources for invention.” Readings in industrial economics. Palgrave, London, 1972. 219–236.

In a knowledge-based economy, the primary competition is competition to innovate first, not competition to cut prices, as standard economics posits. Because sole ownership of an innovation gives monopoly power, the economic laws of perfect competition do not govern innovators. Their monopolies reward their investments in innovation. But unlike monopolies in standard economic theory, innovation-based monopolies are temporary, for they last only until another innovator makes yesterday's innovation obsolete.

The effect of intellectual property rights is therefore simply to prolong innovators' monopolies long enough to provide a sufficient incentive, without stifling further innovation.

The impression that more IP protection necessarily drives development is one reputed reason that international minimum standards for IP protection were regularly ratcheted up throughout the twentieth century. Developed countries, with the help of key private sector and international organizations, have in various ways pressed upon developing countries the idea that strong systems of IP protection are always good for development, and stronger (less open) systems are even better.

With the World Trade Organization's (WTO, see Box 3) Agreement on Trade Related Aspects of Intellectual Property (TRIPs, see Box 4), WIPO treaties on copyrights, patents, and trademarks, and other bilateral and multilateral agreements, international standards of IP protection have risen to unprecedented levels. These standards apply homogeneously to participating countries at very different levels of development, regardless of their varying economic, social, and cultural circumstances. A few concessions do exist in terms of the substance and timing of obligations for developing and less-developed countries, but the normative principles in international IP laws are presumed to apply globally.

Box 3. The World Trade Organization (WTO)

The WTO is an intergovernmental organization concerned with the regulation of international trade between nations. The WTO officially commenced on 1 January 1995 under the Marrakesh Agreement,^{xiii} signed by 123 nations on 15 April 1994. In 2001, the last large world economy, China, became a member. There are now 164 member countries at the WTO.

The WTO deals with regulation of trade in goods, services, and intellectual property between participating countries by providing a framework for negotiating trade agreements and a dispute resolution process involving independent judges aimed at enforcing participants' adherence to WTO agreements, which are signed by representatives of member governments and ratified by their parliaments.

Importantly, prior to joining the WTO, a country is under no international multilateral obligation to protect foreign companies' IP within their own borders, meaning "counterfeit" or "fake" goods can be produced and sold domestically without the foreign owner of the IP having any recompense.

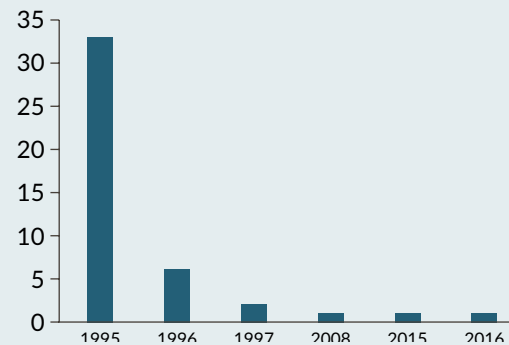
(continued)

Box 3 (continued)

Forty-four African countries are members of the WTO as of 2020 (blue in map below), with nine countries holding “observer status” (green in map) and only one, Eritrea (red in map), not affiliated at all. Notably, the vast majority of these countries joined the WTO before China, which became a member in 2001.



Number of African countries joining WTO per year



Box 4: Trade-Related Aspects of Intellectual Property Rights Agreement (TRIPS)^{xiii}

The TRIPS Agreement, which came into effect on 1 January 1995, is to date the most comprehensive multilateral agreement on intellectual property. Agreed between all 164 WTO member countries, it establishes minimum standards for the regulation and enforcement by national governments of many forms of IP (including copyright, patents, geographical indications, and trademarks) as applied to nationals of other WTO member nations.

Early criticism of TRIPS included that its minimum standards applied across countries regardless of their stage of development and its relevance and support or otherwise for national economic development strategies.

However, TRIPS incorporates some “flexibilities” **permit less developed countries to follow public policies either in specific fields (like pharmaceuticals) or more generally for macro-level, institutional policy targeting economic development, while remaining TRIPS- (and therefore WTO-) compatible.**

Concerned that developed countries were insisting on an overly narrow reading of TRIPS, developing countries initiated a round of talks that resulted in the 2007 Doha Declaration,^{xiv} **which clarified the scope of TRIPS and affirmed that, for example, it should not prevent members from taking measures necessary to protect public health (such as through compulsory licensing).**

Still, many people still consider that TRIPS hinders economic growth in less developed countries, as the “flexibilities” are limited and/or difficult to utilize, and ultimately the fundamentals of the system were not designed with developing countries’ economic growth as its priority.

However, in recent years, there has been increasing questioning of the Arrow-based model. Are these “temporary monopolies” actually encouraging more innovation by increasing the economic rewards to successful innovators (and preventing others from “free-riding” on their ideas)? Or are they slowing innovation by reducing the flow of information to other potential innovators, as well as reducing the incentives for yesterday’s winners to further innovate?

As a result, this theory of strong intellectual property rights supporting economic growth has been disputed by many scholars, who argue the following:

- The patent system, by monopolizing knowledge, widens the gap between developing countries (limited access to IP) and developed countries (rich existing access to IP).^{xv}
- Both theory and historical evidence suggest that development, at least in its initial stages, is best promoted by a weaker intellectual property regime than reflected in TRIPS, or at the minimum a markedly different regime. China’s growth story, in particular, contributed to this debate—discussed further in Section 2.
- In many cases, especially in developing countries, there is a wide gulf between IP laws on the books and day-to-day realities on the ground.^{xvi}
- The concept of patent lives looks at the balance between two factors: longer patent lives give a greater financial incentive to prospective innovators, but also slow the diffusion of the innovation through the economy.^{xvii} It is not known whether current patent lives are optimal or otherwise, nor whether they should differ across industries, or even for different innovations in the same industry,^{xviii} let alone countries at different stages of development.
- Patent protection has many gaps. Corporate espionage, reverse engineering, and superficial alternate designs can evade or circumvent patent protection. Consequently, innovative corporations tend to protect financially important innovations with a cloak of secrecy. A survey of 650 individuals in 130 lines of business and found that patents are rated as the least effective means of protecting process innovations, behind secrecy, superior sales and service efforts, learning and experience, and lead time.^{xix} Approximately 60 percent of respondents also reported that competitors can easily invent around a patent.^{xx}
- Much of this theory was developed in the United States after World War II, and while the US middle class was expanding quickly with new domestic technologies. At that time many developing (and most African) countries were still administered as colonies. Times have changed, and theories need updating.
- Scholars have increasingly discussed the tensions between knowledge sharing and protecting in open innovation^{xxi}—a concept involving businesses and organizations sourcing ideas from external sources as well as internal ones, with the open invitation of a wider group of people to participate in product development and innovation, instead of the secrecy and silo mentality of traditional business R&D. This phenomenon is termed the paradox of openness (Arora et al., 2016; Bogers, 2011; Laursen and Salter, 2014; Wang et al., 2017).

Indeed, some analysts now suggest that “the current global regime of intellectual property rights is inadequate in serving the purpose of economic development and welfare.”^{xxii} However, China’s experience does not yet play an important role in the discussion; we return to this later.

For now, we ask, how does this apply to African contexts?

The current status of innovation and IP rights protection across Africa and in China

This section provides an overview of the present-day IP and innovation environment in African countries by analysing African countries’ positions in related indexes. In almost all innovation- and IP-related indexes, almost all African countries included are ranked towards the bottom, and mostly below China.

IP rights protection

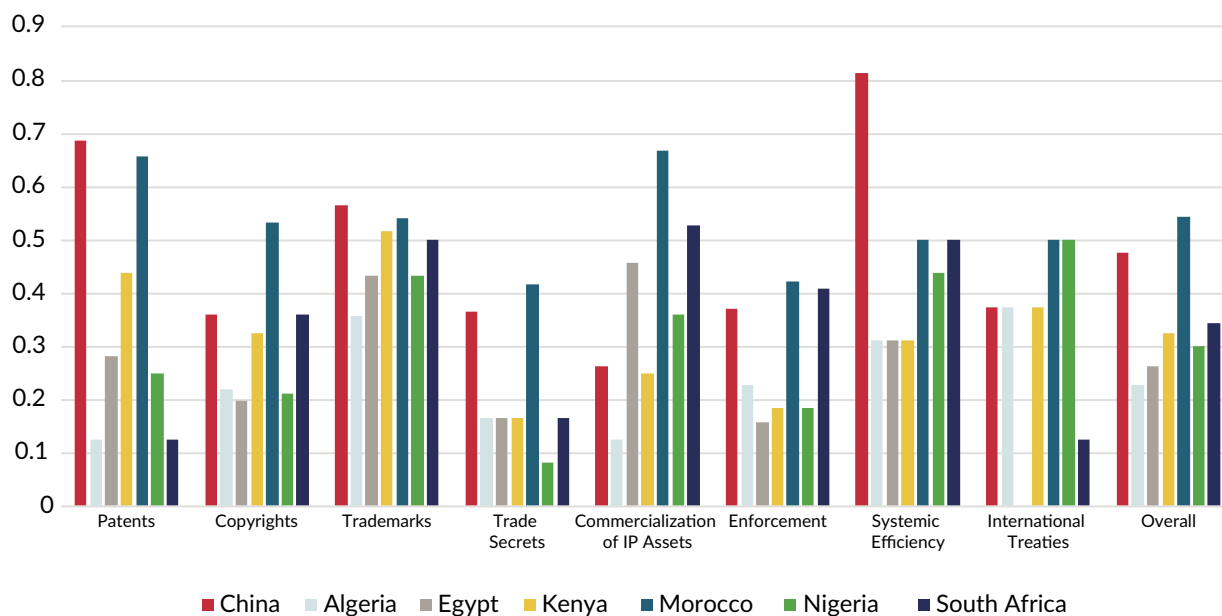
Figure 5 summarises the current status of IP protection, as ranked by three indexes/rankings. It is worth noting that 14 African countries^{xxiii} were not included in any of the three indexes analysed, and data is not available to determine trends in China or Africa before 2000.

Figure 5. Ranking IP protection in Africa and China

Rank (among African countries and China)	Protection of Intellectual Property Rights Index—Property Rights Alliance 2019 (31 African countries, 129 total)	Intellectual Property Protection— Global Information Technology Report 2016 (37 African countries, 139 total)	Global Innovation Policy Centre—IP Index 2019 (6 African countries, 50 total)
1	South Africa (30)	South Africa (24)	Morocco (21)
2	Ghana (48)	Rwanda (28)	China (25)
3	China (49)	Namibia (36)	South Africa (38)
4	Rwanda (54)	Mauritius (41)	Kenya (41)
5	Morocco (57)	Botswana (47)	Nigeria (44)
6	Tanzania (59)	Zambia (46)	Egypt (48)
7	Burkina Faso (66)	Lesotho (57)	Algeria (49)
8	Egypt (68)	Morocco (61)	
9	Sierra Leone (70)	China (63)	
10	Mauritius (72)	Ghana (74)	

According to the **2019 GIPC International IP Index**, an annual index produced by the US Chamber of Congress that evaluates IP protections in 50 countries, China ranks 25th, above all six African countries ranked in the Index other than Morocco (ranked 21st). Figure 6 highlights the component breakdown for the African nations and China on the GIPC IP Index. It shows China’s strengths are primarily in patent protection and systemic efficiency, due to a strong pharmaceutical patent enforcement system and new e-commerce legislation against the sale of counterfeit goods online.^{xxiv}

Figure 6. Indexed GIPC 2019 IP Index Component Score for African Countries and China



However, China is considered to also have several IP protection weaknesses. There are still significant challenges with technology transfer, market access, licensing, and effective commercialization of IP, as evidenced by China’s below-average scores in some of the categories in Figure 6 above. There is often still direct government interference in licensing agreements, as well as requirements of technology transfer for market access. Finally, China’s IP laws, in many ways, are considered out of sync with international standards.^{xxv}

The **Property Rights Alliance’s (PRA) 2019 Protection of IP Rights Index**, which includes 37 African countries, ranked China below two African countries overall: South Africa and Ghana. However, in the PRA’s specific sub-index for patent protection, China is ranked above every country on the African continent.

In the **World Economic Forum/INSEAD 2016 Global Information Technology Report**, seven African countries are ranked higher for “Intellectual Property Protection” than China, including Lesotho and Namibia.

Two African countries stand out in these rankings. South Africa, which beats China on two of the three indexes, and Morocco, which also ranks highly in all three and does especially well on measures for copyright protections in comparison to China.

If China and most African countries rank low on IP rights globally, how do they rank in terms of innovation?

Innovation

On innovation, China comes significantly further ahead of African countries on a variety of indexes than for IP protection. Figure 7 shows the top 10 (where available) on indexes for innovation among the included African countries and China. Once again, 14 African countries were not included in any of these indexes,^{xxvi} and data is not available to be able to determine trends in China or Africa before 2000.

Figure 7. Ranking innovation in Africa and China

Rank (among African countries and China)	Global Innovation Index 2019 (30 African countries, 129 total)	International Innovation Index 2009 (21 African countries, 110 total)	Capacity for innovation—World Economic Forum 2017 (35 African countries, 137 total)	Bloomberg Innovation Index 2020 (4 African countries, 60 total)
1	China (14)	China (27)	Guinea (13)	China (15)
2	South Africa (63)	South Africa (34)	South Africa (30)	Algeria (49)
3	Tunisia (70)	Tunisia (41)	Kenya (38)	South Africa (50)
4	Morocco (74)	Mauritius (45)	China (44)	Tunisia (52)
5	Kenya (77)	Lesotho (59)	Benin (47)	Egypt (58)
6	Mauritius (82)	Egypt (65)	Rwanda (50)	
7	Egypt (92)	Botswana (66)	Cameroon (52)	
8	Botswana (93)	Morocco (70)	Mauritius (54)	
9	Rwanda (94)	Ethiopia (77)	Senegal (55)	
10	Senegal (96)	Algeria (85)	The Gambia (61)	

On the Global Innovation Index (GII), China's score is significantly higher than all Africa countries and regions, as well as the global median, as shown in Figure 8. South Africa is the only African country to beat the global median on this index in terms of both inputs (five input pillars capturing elements of the national economy that enable innovative activities) and outputs (two pillars that result from innovative activities within the economy).

Figure 8. Global Innovation Index—comparing African countries and China

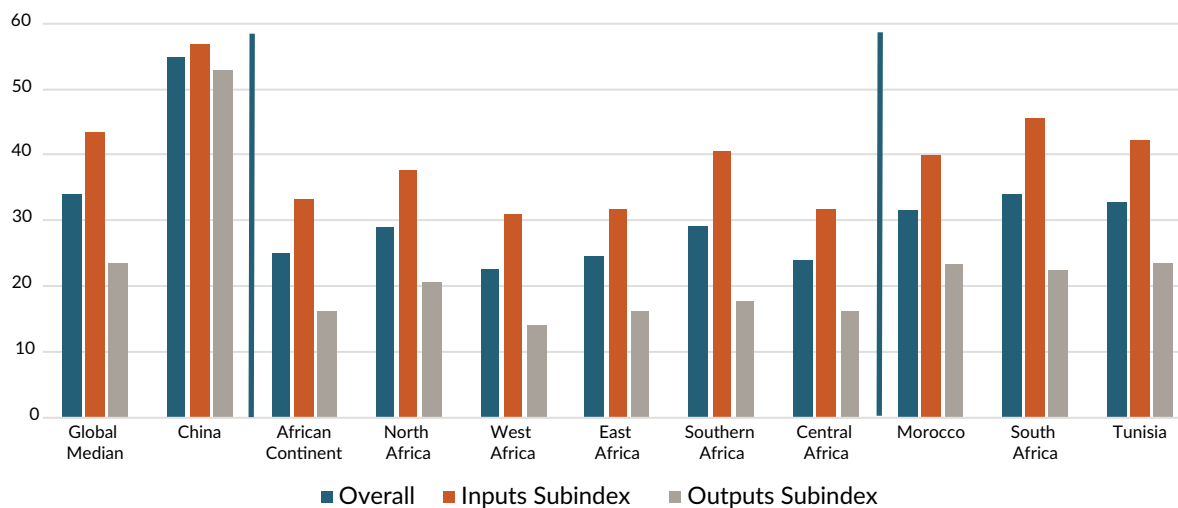
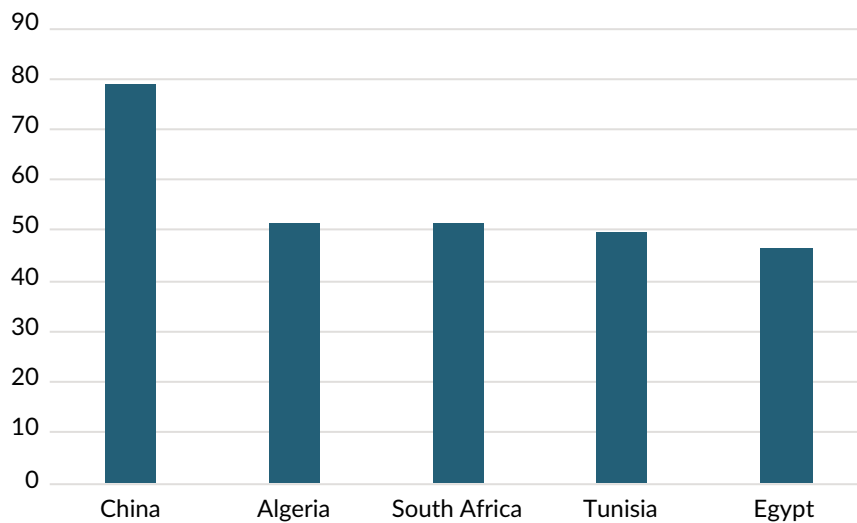


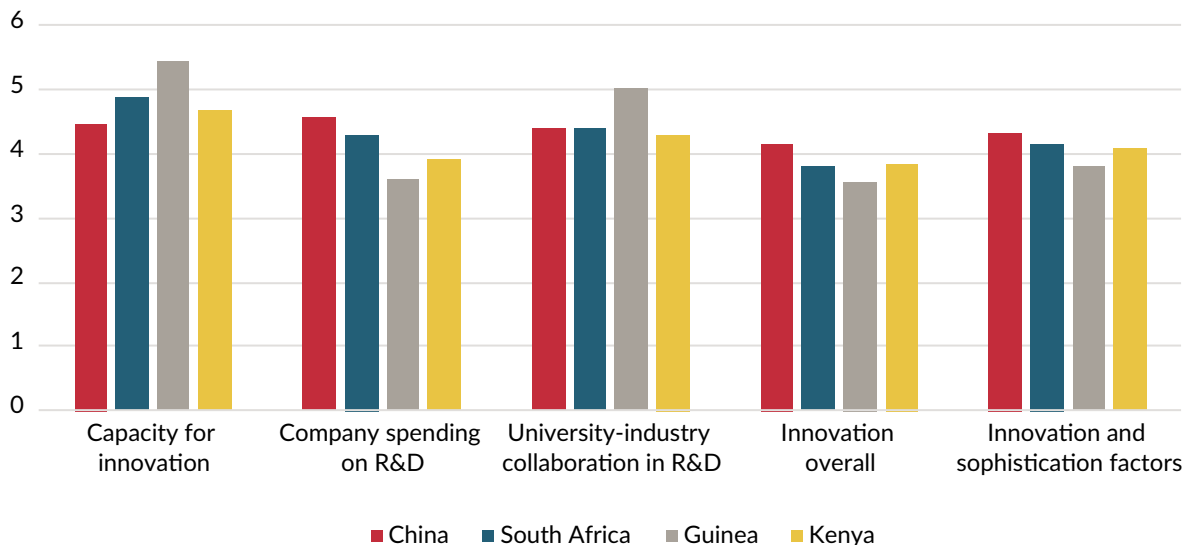
Figure 9. Bloomberg 2020 Innovation Index Scores—comparing African countries with China



This contrast is broadly replicated by the Bloomberg Innovation Index (shown in Figure 9), which covers the top 60 countries for innovation in the world. China is ranked 15th, well above Algeria, Egypt, South Africa, and Tunisia, the only four African states included (Jamrisko & Lu, 2020).

The World Economic Forum’s Global Competitiveness Reports analyses innovation along a few clear dimensions. As Figure 10 shows, on some measures Guinea, Kenya, and South Africa are classed higher than China. Guinea in particular stands out for its capacity for innovation and university-industry collaboration in research and development, both of which are higher than China’s.

Figure 10. Global Competitiveness Report Innovation Scores—comparing African countries and China



In 2005, China reached the same level of GDP per capita (constant 2010) as Africa in 2019, at around US\$1,600.^{xxvii} At this time, China was far more industrialized than present-day Africa (which is still heavily raw materials based), and only recently became a member of the WTO. And yet, prior to then it still had economic growth, as well as innovation growth—contrasting with Arrow’s theory, as in Box 2. How did China achieve this? The next section expands on this by looking at the “China model.”

3. WHAT IS THE CHINA MODEL OF INNOVATION AND IPR?

China’s story of innovation, IPR, and growth is an informative case study into paths that African countries could potentially explore. But what is this model? What policies were employed at what times? This section will seek to answer those questions, first, with a critical outline of the innovation model, and then with a closer look at certain policy characteristics relating to innovation and IP, as well as their impact.

The model: Innovation with Chinese characteristics

The Chinese model of promoting and fostering innovation has come about through key changes in China’s system of policymaking, reforms of its financial structuring, and the cultivation of a suitable industrial ecology that eventually forms a circle of incentives and innovation, with the state taking a commanding role in effecting these changes. While this symbiotic relationship between policy, finance, and industry is not unique to China, it does come with its own characteristics. First and foremost is the existence of a dominant, yet pragmatic, state authority from the central to local levels that is able to formulate and execute innovation policies.

The presence of a political system that combines state-ownership with a market-based hybrid economy is a defining feature of China’s model of innovation. At both national and local levels, officials place a great deal of focus on innovation when it comes to long-term strategic direction.^{xxviii} A strong political and governmental focus on innovation and its importance has been a key characteristic of China’s innovation model ever since China began to reform and open up in the late 1970s. Indeed, in 2019, China’s president Xi Jinping stressed that “innovation is the first driving force for development.”^{xxix}

This approach is also seen in the construction of collaborative innovation centres and technology parks across the country to support businesses, research institutes, and individual innovations, alongside the state provision of policy initiatives, regulations, and research funding. Ultimately, the state positions itself as a mechanism to drive forward innovation. This is especially evident in its policy to decentralise and diversify the innovation process, particularly in the field of science and technology. As a result of the policy guidance, target setting, and capital mobilisation at the central level, local authorities enjoy substantial freedom to chart their own courses in terms of policy programmes and resource management, thereby adding an element of competition between administrative divisions. Most provinces and municipalities have established so-called guidance funds, which bring together state and private investors to support innovative enterprises. China’s growing R&D expenditure, estimated at US\$257 billion in 2017, is evidence of this, along with increasingly successful capital-raising on both public and private markets for technology start-ups. Local authorities also provide subsidies to firms to shore up talent and liquidity, which, combined with efforts aimed at streamlining administrative procedures, enhance the ease of doing business. Finally, the state also has an important role to play as a consumer, illustrated in recent years by the development of innovations in surveillance

infrastructure, facial recognition technologies, and smart transportation. This structure also allows for the creation of an effective support system for innovators and entrepreneurs to experiment and advance. In the following section, Shenzhen's emergence as the "Silicon Valley of China" is discussed as a case study.

China's innovation and IP story, as seen domestically and internationally, is briefly introduced in Figure 11 below, while the remainder of this section analyses eight features of the "China model of innovation":

1. Strong policy support for the introduction of foreign technologies
2. Late introduction of IP laws relative to level of economic development
3. Late accession to the WTO
4. IP and innovation openness
5. Quick adaptation to and adoption of new technologies (such as 3D printing, e-commerce, AI, mobile payments, and blockchain technologies)
6. Experimental (and often competitive) policymaking
7. Huge domestic market and economies of scale
8. High spending on R&D and human capital

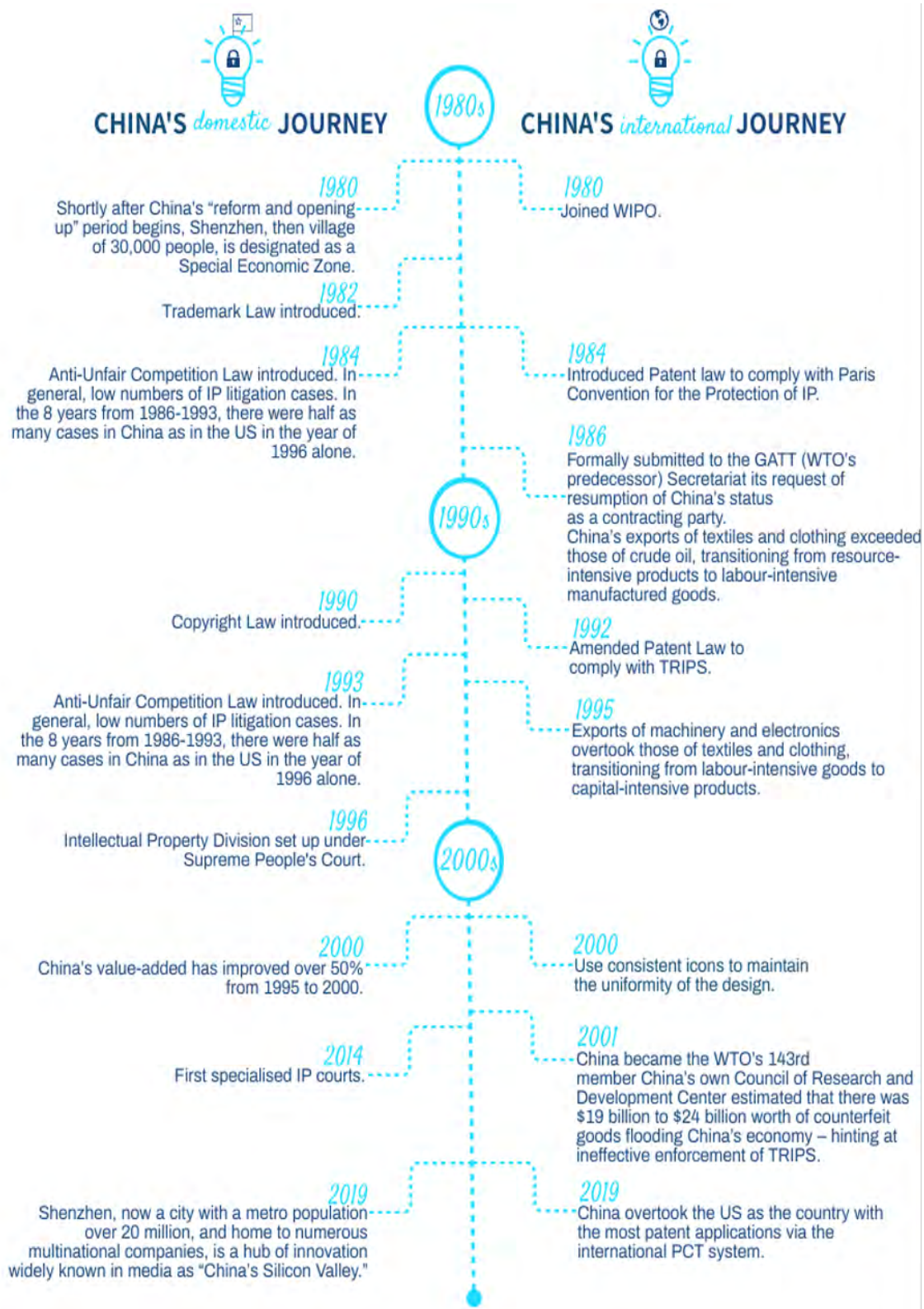
Strong policy support for the introduction of foreign technologies

In the 1980s, most Chinese firms introduced significant amounts of foreign technologies and equipment,^{xxx} with state backing through policies including the "Regulations of the People's Republic of China on the Administration of Technology Acquisition Contracts" (1985) and later, "Regulations of the People's Republic of China on Administration of Import and Export of Technologies" (2001), which broadly encouraged "the import of advanced and useful technologies." However, the latter document makes it clear that these technologies must be appropriate, and should support the development of new products, improve quality and performance, reduce costs, or favour the improvement of management, contributing to the advancement of general scientific and technological capacity in China.

In 1986, China's Ministry of Finance, State Development and Reform Commission, and the General Administration of Customs jointly published "Regulations of Promoting Technology Introduction, Digestion and Absorption." This "Introduction, Digestion and Absorption" approach was supported by policies including a requirement that foreign companies in China include a Chinese partner in a joint venture model, guaranteeing that Chinese organizations and employees would have greater exposure to technologies introduced by foreign companies. Tax policies and other incentives/benefits introduced in the State Council's 1990s-issued "Provisions on the Encouragement of Foreign Investment" to attract foreign investors, capital, and companies to China, especially in the context of special economic zones, also helped support this ambition.

This introduction of foreign technologies into China allowed Chinese entrepreneurs to quickly climb the innovation ladder, "leapfrogging" technologies, such as landline phones and credit cards, more directly to innovation-boosting mobile phones and mobile payments.

Figure 11. China's innovation and growth story



Late introduction of IP laws relative to level of economic development

China's initial IP-related laws were introduced relatively late, with the first relevant law introduced in 1982, almost 40 years ago. Figure 12 provides more detail.

Figure 12: Intellectual property laws in China

Type	Patent Law	Trademark Law	Copyright Law	Anti-Unfair Competition Law
When	1984	1982	1990	1993
Changes before joining WTO	2 Amendments	2 Amendments	1 Amendment	No Amendment

Enforcement procedures were in place by the late 1980s, but the number of litigation cases was low, as were awards of compensation or fines in these cases. For example, in the United States, there were 7,247 IPR cases in 1996 alone, more than double the number of judicial IPR litigation cases in China for eight years (1986–1993).

Furthermore, China joined WIPO in 1980 and set up the Intellectual Property Division under the Supreme People's Court as recently as 1996. China's first specialised IP courts were established only in 2014.

Gradual introduction and strengthening of laws

China's Patent Law^{xxxix} was enacted after the country began the policy of "opening up and reform," and after it established its Special Economic Zones, but earlier than its accession to the WTO. It is worth looking into this law further as an example of China's approach to IP.

Figure 13 describes the progress of the law, with reasons cited, while Figure 14 gives an overview of the practical legal framework for patents in China.

Figure 13. Patent Law in China^{xxxix}

Year	Incident	Occasion	Reason
1984 ^{xxxix}	First adopted 69 articles	4th Meeting of the Standing Committee of the 6th National People's Congress	Comply with Paris Convention for the Protection of Intellectual Property
1992 ^{xxxix}	First amended 69 articles	27th Meeting of the Standing Committee of the 7th National People's Congress	Comply with The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs)
			Expansion of scope of protection
			Strengthens rights of patentees
2000 ^{xxxix}	Amended for second time 69 articles	17th Meeting of the Standing Committee of the 9th National People's Congress	Extends duration of protection
			Fully align with TRIPs
			Further strengthens rights of patentees
			Opportunities for judicial review
			Details the compulsory licensing regime

Figure 14. Legal framework of patents in China

Standards of patentability	Inventions must meet requirement for novelty, utility, and non-obvious inventive step
	No requirement of disclosing prior art relevant to application.
	Invention is still considered novel for a six-month “grace period” after disclosure to the public.
Receipt	First-to-file
Procedure	Patent application is published for inspection and opposition 18 months after application
	Single-claim preferred, though multiple-claim allowed in specific situations
	Examination starts at the applicant’s request, and request must be submitted within up to three years after application
	Foreign applicants must submit applications through Chinese registered attorneys
Duration	Twenty years for inventions
	Ten years for utility models and industrial designs
Compulsory licenses	Government may require patentees to license technologies to others if needs for national security or emergency arise, and others make reasonable offer to implement the technologies
Cross-licensing	Crossing-licensing allowed

As is clear from both figures, China only gradually strengthened its laws over time, bringing in absolutely necessary “minimum elements” rather than bringing it in full force immediately.

Late accession to the WTO

China did not achieve WTO membership until late 2001, making it the 143rd country to join, behind the majority of African countries. Fourteen African countries joined the WTO on the day it began life—1 January 1995^{xxxvi}—while the most recent African country to join was Liberia in 2016.

Prior to WTO accession, China had already seen great progress in manufacturing/innovation:

- China’s manufacturing sector had already undergone changes before 2001, with the export value of goods increasing and deepening manufacturing capacity.
- In 1986 exports of textiles and clothing exceeded those of crude oil, showing a transition from resource-intensive products to labour-intensive manufactured goods.
- In 1995 exports of machinery and electronics overtook those of textiles and clothing, showing a transition from labour-intensive goods to capital-intensive products.
- Between 1995 and 2000, China’s value-added improved over 50 percent.
- Between 1995 and 2000, China’s medium- and high-tech export increased 11 percentage points.

The improvement of industrial competitiveness was attributed to national development strategy and industrial policy, which in turn was designed to fit into China’s comparative advantages (such as abundant cheap labour).

China's progress prior to joining the WTO can also be seen in the changes of the composition of its exports and imports over the decades. Figure 15 shows the structure of China's exports changed dramatically between 1995 and 2000 (before ascension to the WTO), before continuing to adapt in years after. Before it joined the WTO, China's exports were mostly low-technology products, such as consumer goods, textiles, and clothing. As China moved up the supply chain, low-technology exports were gradually replaced by items with higher value-adding features, such as mechanical and electrical goods and capital goods, setting the stage for more IP-protection needs for Chinese exports. The number of foreign-oriented Chinese patents was very few before 2001, perhaps because China focused on low-tech goods.

Figure 15. China's changing export structure over time^{xxxvii}

Product categories	Indicator	1995	2000	2015	1995-2000
Consumer goods	Export product share (%)	53	50	38	Dropped 3 % point
Textiles and clothing	Export product share (%)	24	20	12	Dropped 5 % point
Intermediate goods	Export product share (%)	23	17	16	Dropped 6 % point
Machinery and electrics	Export product share (%)	19	29	42	Up 10 % point
Capital goods	Export product share (%)	16	28	44	Up 12 % point
Total foreign-oriented Chinese patents		203	863	4851	Up 320%
Rank relative to the world (country-basis)		26	19	5	

The structure of China's imports showed concurrent changes, as shown in Figure 16. China has gradually begun the process of moving from importing intermediate goods, to importing raw materials, which led to more value-adding/tech-enabled services in the value chain. Patent applications in China, although not large in absolute numbers, were already quite high before China joined the WTO, compared to other countries. The number of non-resident entities applying for IP in China was relatively large (almost same as resident entities) before 2001. As China's main imports start moving to raw materials for export of technology-oriented products, more innovations emerged, creating incentives for Chinese residing entities to protect their IP; in contrast, prior to 2000, a relatively large number of non-resident entities applied to protect their innovations in China. The patent granting rate is in general low in China, although it has increased significantly over the years (US 1995 success rate 44 percent, 2000 53 percent, 2015 51 percent).

Figure 16. China's changing import structure over time^{xxxviii}

Product categories	Indicator	1995	2000	2015	1995-2000
Capital goods	Import product share (%)	39	41	42	
Intermediate goods	Import product share (%)	39	35	24	Dropped 4% point
Consumer goods	Import product share (%)	11	9	12	
Raw materials	Import product share (%)	10	14	22	Up 4% point
Total patent applications in China		18699	51906	968252	Up 180%
Rank relative to the world (country-basis)		8	5	1	
% of resident		54%	49%	88%	
% of non-resident		46%	51%	12%	
Granted Patents in China		3393	13058	359316	
Success Rate		18%	25%	37%	Up 7% point

IP and innovation openness

Through a combination of the late introduction of (both domestic and international) IP laws, their relative lack of strictness, and a lack of enforcement, China's IP and innovation environment remained open relative to other countries. This openness is credited—at least in domestic narratives—with supporting China's pace of innovation and innovation-driven development.

Between 1985 and 1999, China's patent system was more oriented towards promoting technology diffusion rather than protecting inventors' rights.^{xxxix} A study of Chinese firms found that the more open the innovation process, the higher innovation performance would be, and that “the ability of using and integrating external knowledge is crucial for Chinese firms to improve the technological innovation capability.”^{xl}

However, this environment also lends itself to counterfeiting—and indeed, China's own Council of Research and Development Center estimated that there was \$19 billion to \$24 billion worth of counterfeit goods flooding China's economy in 2001. China has been considered the world's leading infringer of intellectual property rights for many years^{xli} Today, the majority of the world's counterfeit goods are made in China, with many of them also consumed in the country.

Quick adaptation to and adoption of new technologies, with the pace of innovation outpacing IP registration and implementation or enforcement

In China, the emphasis is often on getting an idea to the market quickest, rather than prioritising IP registration. By the time IP is registered and enforced, it is often too late for it to have any impact—the market has already moved on to the next innovation. This is buffeted by fast adaptation and adoption of new technologies, such as 3D printing, e-commerce, AI, and crypto-technologies. See Box 5 discussing the city of Shenzhen, which has become the go-to example of this type of IP openness and related innovation.

In recent years, the quick adoption of mobile payment systems (with WeChat and Alipay at the forefront) and e-commerce (Alibaba, JD.com, Pinduoduo) and logistics platforms (such as Cainiao, and JD.com's in-house logistics) have lowered barriers to market entry for entrepreneurs and innovators.

Box 5. Shenzhen's innovation and growth story—the “Silicon Valley of hardware”

Shenzhen, now a city of over 12 million people, has seen its GDP swell 10,000-fold in the 40 years since its designation as a Special Economic Zone in 1980. At US\$30,000, its GDP per capita is among the highest in China, and similar internationally to Portugal. In its 40th anniversary year, the city has been the focus of much discussion regarding development in China, and it serves as a useful case study of innovation and IP.

Forty years ago, Shenzhen had a population under half a million, while today it has been called the “world's most innovative city”^{xlii} and “the Silicon Valley of hardware.”^{xliii} It is home to a number of world-leading companies, such as Tencent, ZTE, OnePlus, Huawei, DJI, and BYD. But how did it become such a hotbed of innovation?

(continued)

Box 5. Continued

Four key factors account of Shenzhen's transformation:

1. Industrialization and hub of manufacturing in China: Shenzhen was one of the first four Special Economic Zones in China, designated in 1980. Alongside the growth of factories themselves, physical and human capital became concentrated to develop in the city as part of China's export-led growth strategy.
2. The huge *shanzhai* community, made up of entrepreneurs and companies historically based on a strategy of imitating high-end products: The electronics and information industry in the region of Shenzhen experienced a great change from technical introduction, cooperation, imitation to innovation which is a model of open innovation without borders between enterprises.^{xiv}
3. Policy: Shenzhen has a wealth of start-up accelerators, incubators, government-supported “maker spaces,” and a stock exchange with a partial focus on attracting innovative companies.
4. Open innovation: “The Shenzhen way is to share and build on one another’s designs, always striving to be the best, fastest, most innovative design,” according to Will Canine, the founder of an American startup operating in Shenzhen. “This open competitive environment is a great way to keep technology advancing quickly, and also ensures customers are benefiting from innovation immediately.”^{xiv} The Shenzhen ecosystem relies largely on practices associated with being open-source.^{xvi}

An excellent practical example of products grown from this open innovation environment is that of hoverboards, for which no one company owns the primary intellectual property, and a large industry of companies in Shenzhen have openly built upon each other’s ideas without IP as a consideration.^{xvii} There are numerous similar product examples in the city.



Modern Shenzhen

Experimental (and often competitive) policymaking

As in many other sectors of policy in China, and as described by Yuen Yuen Ang,^{xlviii} different authorities (such as provincial governments) are often given the leeway to experiment with different policies in their jurisdictions aimed towards achieving the same goal. In the context of innovation and IP, this includes R&D policy, and the extent to which IPRs are enforced, with the overarching goal being competition for high economic growth—the overriding focus of China’s government since “reform and opening up” policies were initiated.

This experimentalism allows for analysis of the success or otherwise of different policy solutions, eventually meaning the most successful solutions become known, and can be replicated across the country, improving outcomes country-wide.

Huge domestic market and economies of scale

Immediate access to the world’s second largest economy with over 1.4 billion consumers makes it easier for innovators to test their products, enjoy economies of scale, and grow their enterprises, without need to consider international IPR agreements; they can focus domestically and still reach a huge market. As poverty has fallen in China, its domestic consumer market has grown rapidly.

High spending and investment on R&D and human capital

China’s spending on research and development has risen dramatically over the last 20 years, reaching \$322 billion in 2019, with basic research accounting for 6 percent of the total; applied research, 11.3 percent; and development, 82.7 percent. The spending amounted to 2.23 percent of GDP, although China has a goal to reach spending 2.5 percent of GDP. For comparison, according to OECD figures, in 2018 the United States spent 2.83 percent of GDP on R&D, with the OECD as a whole spending 2.38 percent of GDP, and South Korea spending 4.5 percent of GDP.^{xlix} In contrast, in 2001, when China acceded to the WTO, it was spending 0.9 percent of GDP on R&D.¹ This spending has allowed more experimentation, and arguably gone alongside abovementioned policy shifts.

Furthermore, human capital—that is, educational achievements—in China have made huge improvements, at early and late stages. For example, between 1980 and 2010, the average number of years of schooling in China increased from 3.78 to 7.55 years.^{li} In 2000, just before China acceded to the WTO, 8 percent of China’s young people went to university. By 2018, that had risen to 51 percent.^{lii} This more highly educated population provides demand for innovation as well as increases the ability to innovate.

But how applicable and useful could this new model be to others, especially in African economies?

4. HOW RELEVANT IS THE CHINA INNOVATION MODEL TO AFRICAN COUNTRIES?

If China grew without enforcing IP, yet has shown extensive and fast-growing innovation, could Africa do the same? If thinking is progressing also in terms of the role of “open innovation” versus strict protection, what can be the role of IP and innovation in Africa? Is there a new path—a new economic model—that African countries can use to their advantage? This section aims to answer these questions by analysing the extent to which China’s experience is and is not applicable to African countries. Each feature of the Chinese model is then discussed with regard to applicability across Africa—with country, regional and continental level considerations highlighted where appropriate.

What makes China’s experience applicable to African countries?

We can identify six specific features that make China’s experience applicable to African countries.

1. *Burgeoning levels of innovation across the continent*

As noted earlier in Section 3 of this paper, some indices rank some African countries higher than China in innovation (e.g. WEF). Indeed, for all of the innovation indices discussed in Section 1, the general trend has been upward for African countries recorded, albeit from low levels. Mauritius (ranked 52nd globally in the 2020 Global Innovation Index), South Africa (60th), Tanzania (88th), and Botswana (89th) have all improved their rankings compared to 2019, along with Malawi, Madagascar, Zimbabwe, Zambia, and Togo, among others, shown in Figure 17.

Figure 17: GII 2020 rankings in Africa^{liii}



This is reflected in other more specific data. For instance, in 2019, a report identified over 600 tech hubs in Africa,^{liv} with over 40 in Lagos alone—a part of which has been come to be known as “Africa’s Silicon Valley.” Indeed, 50 percent of all hubs on the continent are in Kenya, Nigeria, South Africa, Egypt, or Morocco.^{lv} Their structure ranges from incubators and accelerators to university-linked start-up support labs, maker parks, and co-working spaces. These measures all indicate a growing interest in innovation, in particular by entrepreneurs and investors, but also by some central and local governments that provide support to such hubs.

2. High interest in special economic zones (SEZs) as a means to achieve scaled-up quick manufacturing—but they can also provide opportunity for new open innovations

Back in the early 1970s, African governments introduced the world’s first SEZs, including as part of a policy of import substitution, which was being promoted at the time. However, for several reasons, many of these zones failed dramatically,^{lvi} and in contrast to those introduced later by Asian countries including China. Since the late 2000s African governments have shown a renewed interest in SEZs. A 2019 UNCTAD report^{lvii} estimated the number of SEZs across Africa at 237, of which 51 are in development. That accounts for 4 percent of the world total. However, many are small. For instance, the most successful SEZs/IPs in East Africa have not yet managed to attract more than 18,000 jobs and US\$325 million of investment. In contrast, one SEZ in Myanmar, located next to China, hires close to 300,000 local employees.

That said, of the new planned SEZs, 10 percent of the world’s total are in Africa. If existing and new SEZs are well planned and thought through, including well located close to or directly incorporating innovation hubs, as Shenzhen did, this could provide a basis for higher growth in innovation, based on China’s model.

3. Fairly low rankings on IP rights

As discussed in Section 2, African countries, like China, rank low on many aspects of IP rights protection, in a number of different indexes. This suggests that African countries could potentially replicate China’s “open innovation” models of development, since policies are not in place to enforce IP.

4. Large, young, and increasingly educated population provides demand for innovation

Africa has the youngest population of any continent, with a median age of just 20, a decade younger than the global median,^{lviii} and the world’s youngest countries are all in Africa, with forecasts for 2020 showing just one non-African country (Afghanistan) in the global top 20.^{lix} As of 2020, almost 60 percent of Africa’s population is under the age of 25.^{lx} China 30 years ago had similar proportions of young people (with a mean age of 20 in 1975^{lxi}), many of which helped innovate and grow China’s economy, growth which African countries would like to emulate.

At the same time, the number of Africans in secondary education, though low compared to other regions, has grown by over 23 million in the 10 years from 2008.^{lxii} The current gross tertiary education enrolment ratio in sub-Saharan Africa is 9.4 percent,^{lxiii} which is well below the global average but has shown steady growth since the turn of the millennium.

This young, educated population can be key in growing innovation and economic development in African countries, much like in China.

5. Interest in innovation supporting technologies such as e-commerce, mobile payments, and smartphones

E-commerce, mobile payments, and smartphone penetration are all growing rapidly in Africa, though these trends vary between regions and countries. In Nigeria, Jumia, an e-commerce platform, has grown rapidly since its inception in 2012. In January 2020, the volume of mobile payments in Nigeria topped 7.4 million transactions, up from just 724,803 in January 2019.^{lxiv} In East Africa, Kenyan payments system M-Pesa has achieved high penetration, while Paystack, a fintech company in Nigeria, recently made headlines after being acquired for US\$200 million, a record for a Nigerian fintech start-up.^{lxv}

These platforms, though innovation in themselves, also support innovation by lowering barriers to market entry and operations costs for start-ups, much like Alibaba and WeChat have helped support in China's innovation story.

6. Significant informal economies

The informal economy in China represented a large portion of domestic output, consumption, and employment during its development. Approximately half of urban Chinese workers belonged to the informal economy as of 2004, a significant increase from the 1990s. Fast-growing, dynamic, and highly competitive, this informal economy contributed and continues to contribute substantially to economic growth. In 2016, it was estimated that over half of employment (discounting agriculture) in China was in the informal economy.^{lxvi} As for what this means for GDP, the IMF has estimated that by 2019, the informal economy contributed to around 10 percent of China's GDP.

IMF estimates from 2017 suggest that there is significant heterogeneity in the size of informality in sub-Saharan Africa, ranging from a low of 20 percent to 25 percent in Mauritius, South Africa, and Namibia, to a high of 50 percent to 65 percent in Benin, Tanzania, and Nigeria, as shown in Figure 18.

The share of informal economic activity in sub-Saharan Africa remains among the largest in the world, though this share has been gradually declining, as is the case around the world (see Figure 19). Sub-Saharan Africa's average share of informality reached almost 38 percent of GDP from the period 2010 to 2014. This was only surpassed by Latin America, at 40 percent of GDP. The informal economy averages 40 percent in sub-Saharan Africa's low-income countries and 35 percent for its middle-income countries. A different characterization also stands out: higher levels of informality are more likely in oil exporters and fragile countries, with an informal economy well above 40 percent of GDP.

Overall, this may suggest that a different approach to IP—similar to China's, with high levels of informality could be adapted across the African continent.

Figure 18. The informal economy in SSA, 2010-2014 average as share of GDP

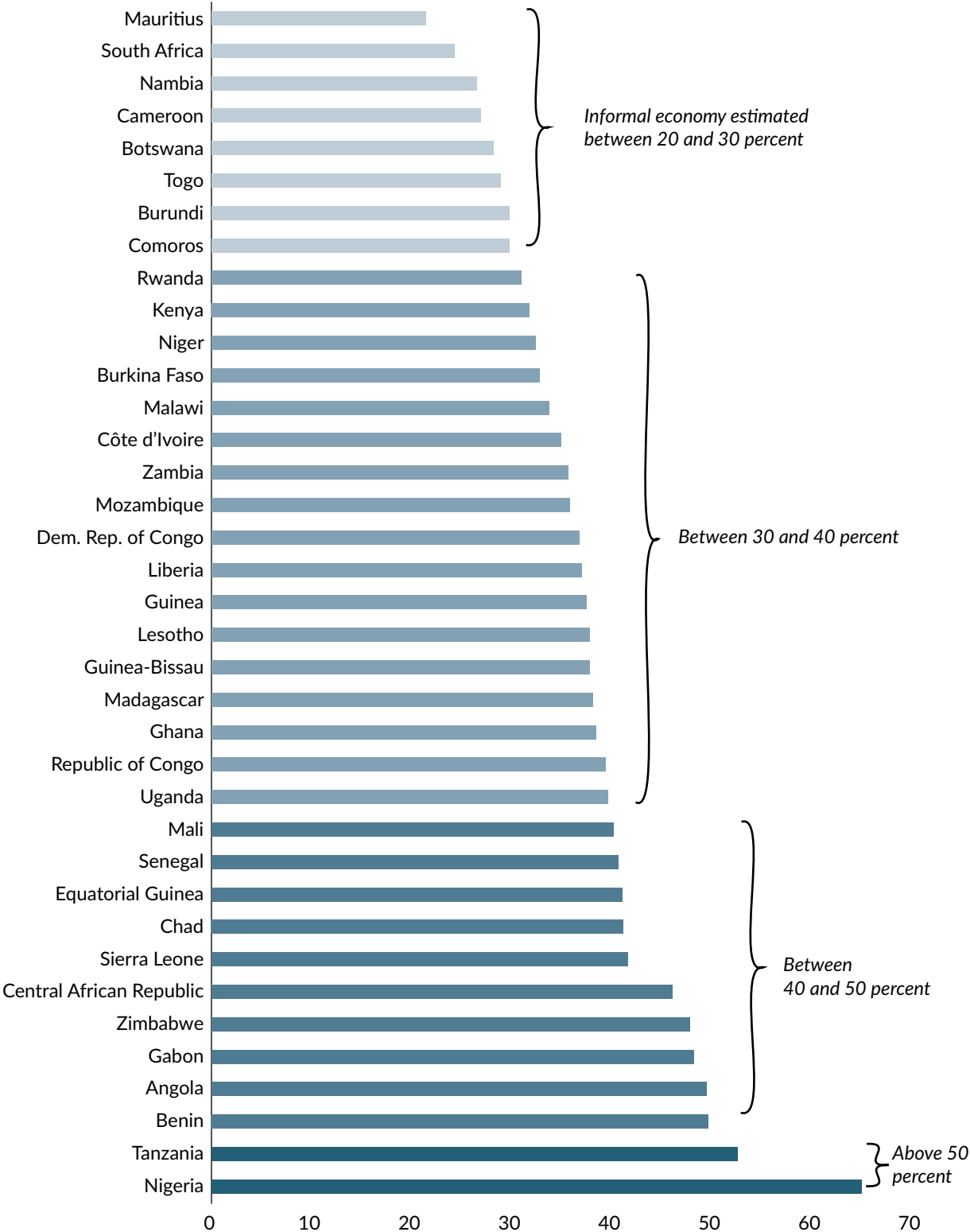
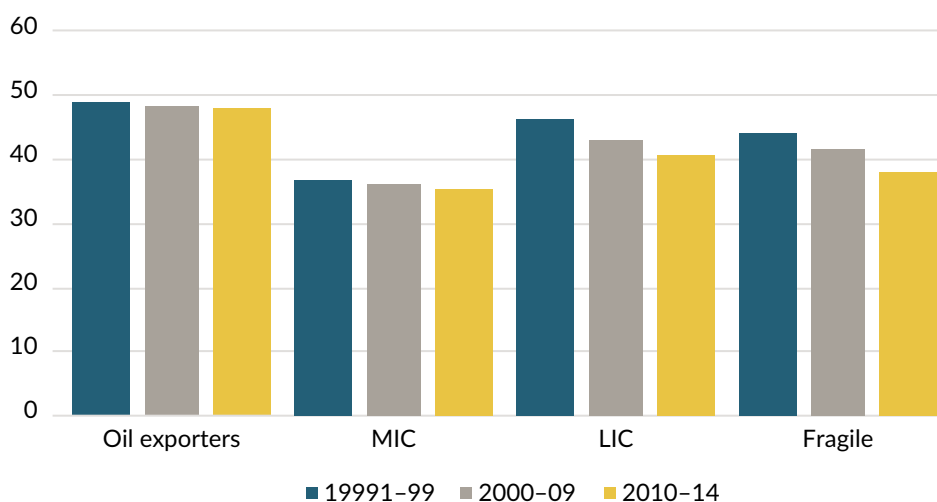


Figure 19. Informal Economy in Sub-Saharan Africa (Average, percent of GDP)



What makes China’s experience NOT applicable to African countries?

Comparing one country—with one government, context, and overarching set of policies—to a continent of 55 countries—each with its own government, context, and great diversity—makes using the same economic model, including from China, an impossible task for all of Africa. This does not mean, however, that individual countries cannot take inspiration from China’s experience. However, it is important to set out key practical challenges in doing so. We see three challenges in particular:

1. Most African countries have already acceded to the WTO (and therefore TRIPS)

Most African countries have already acceded to the WTO (and therefore TRIPS). Only seven African countries are yet to accede to the WTO, meaning the option of delaying meeting strict international IP standards does not currently exist for the large majority of African countries. This also means using a “Shenzhen model” may be very challenging. Indeed, China itself now provides support and funding (pledging US\$ 0.5 million in 2020) for least developed countries in joining the WTO^{lxvii} and has started to seek IP protection for its firms and products in several African markets.^{lxviii}

2. Fifty plus individual countries with a diverse and low range of “supply-side” policies, fiscal space, and incentives

Different governance models in different places could make it difficult to drive up cooperation in IP policy and subsidies across the continent for a particular strategy. While China’s “competitive” model does suggest this might not be an issue, the challenge is that active spending policies are significantly limited by African governments’ fiscal space. For instance, according to UNESCO’s Institute of Statistics (UIS), in 2017 sub-Saharan Africa’s funding of R&D was 0.38 percent of the continent’s GDP, the lowest in the world.^{lxix} This does not bode well for the future.

3. African markets lack “demand-side” coordination—meaning economies of scale are currently extremely hard to achieve—in production and innovation

With 1.4 billion consumers, China is uniquely positioned to excel at customer-focused innovation: an innovator can create a new product or service, and instantly have access to a huge domestic market, without the need to consider international agreements. For instance, a niche industry in China can be larger than a major industry in another mid-sized economy. In 2014, China’s nail care industry was larger than Vietnam’s passenger vehicle market.^{lxx}

African markets, in contrast, are poorly connected with one another, including because of different official languages, making it significantly harder for local companies to reach similar economies of scale both in terms of experimenting with new products as well as creating incentives for innovation. For instance, the African Development Bank lists import quotas, anti-dumping regulations, counter-vailing duties, border tax adjustments, poor infrastructure, political instability, and technical barriers (such as sanitary and phytosanitary measures, rules of origin, standards and qualifications) as persistent impediments to intraregional African trade.^{lxxi}

This also extends to IP offices and other related organizations. While China has one body to oversee intellectual property (the China National Intellectual Property Administration) and, therefore, one application is effective across all of China, the situation in Africa is naturally more fragmented. Beyond African national IP offices, there are two regional offices: the African Regional Intellectual Property Organization (ARIPO), with 20 primarily English-speaking African countries as members,^{lxxii} and the Organisation Africaine de la Propriété Intellectuelle (OAPI), with 16 French-speaking African countries as members. Both organizations allow for an applicant to register its IP across all members. However, ARIPO applicants must specify in which members states they want protection, while for OAPI applications, effective protection across all members is automatic. The combined total membership of these two organizations, at only 36 countries, and the fact that Africa’s two largest economies (Nigeria and South Africa) are members of neither, demonstrates this lack of coordination.

Efforts have been made to harmonize policy and administration between these organizations, ARIPO, OAPI, regional economic bodies, and individual countries. The Pan-African Intellectual Property Office (PAIPO), for example, introduced as a Concept Note in 2006, was adopted as a Statute of the AU in 2016,^{lxxiii} but as of 2020, only six members had signed it, and none had ratified.^{lxxiv}

The African Continental Free Trade Agreement (AfCFTA) presents opportunities to harmonize policies (for IP, for example, via its IP Protocol) and improve connectivity and infrastructure among African countries, which should reduce the difficulties many African innovators face in accessing local, regional, and continental markets. However, it is unlikely to overcome all the challenges (such as language barriers).

Applicability of each highlighted feature of the Chinese innovation model in Africa

We have identified six similarities and three key differences between China and African economies when it comes to the space for innovation and intellectual property protection, and opportunities and challenges in the potential for African economies to use the Chinese innovation model. We turn now to whether the eight specific defining features of the Chinese innovation model that we identified in Section 3 could be applied by African countries.

Strong policy support for the introduction of foreign technologies

This feature could be relatively easily and widely applied by individual African countries. Laws and regulations encouraging or forcing foreign investors to set up joint ventures with domestic companies could be introduced. Ghana, for example, has been promoting joint venture enterprises, with president Nana Akufo-Addo stating in an address during a March 2021 state visit to the Swiss Federation that “our goal is to make Ghana the hub of trade in Africa, and thus, serving notice on Swiss investors to ... set up joint venture enterprises in our country.”^{lxxv}

It is important to note, however, that African countries with larger populations and economies are likely to find more success with introducing these types of regulations—foreign enterprises will be more incentivised to enter into joint venture enterprises with the promise of larger markets.

Late introduction of IP laws relative to level of economic development AND late accession to the WTO

As 44 African countries have already acceded to the WTO (and therefore TRIPS), the options to incorporate these two features in national innovation strategies in most of Africa are limited. For WTO member African countries, introducing less “heavy” IP laws or relaxing their domestic implementation or enforcement may prove difficult overseas, as they could break international agreements. For the others, including Ethiopia, Algeria, and Sudan, this is a more readily available approach.

IP and innovation openness

African countries, as well as China, rank low on many aspects of IP rights protection, in a number of different indexes, as discussed in Section 2. Related to the late introduction of IP laws and late accession to the WTO, this suggests that African countries could potentially replicate China’s “open innovation” models of development, as policies are not yet in place to enforce IP, though once again this depends strongly on each country’s existing IP environments.

Quick adaptation to and adoption of new technologies (such as 3D printing, e-commerce, AI, mobile payments, and blockchain technologies)

There is significant scope and existing evidence of quick adaptation and/or adoption of new technologies in Africa. Like China did, most African countries are in a position to potentially “leapfrog” some technological development steps, such as landlines and traditional personal banking systems.

For example, in 2017, it was estimated that just over half of the 282 mobile money services operating worldwide were located in sub-Saharan Africa,^{lxxvi} and by 2018/2019, many African countries had more citizens accessing mobile money than a traditional bank account.^{lxxvii} Thirty-two percent of Nigerians surveyed in 2020 said they used or owned cryptocurrency (which is based on blockchain technology), a higher proportion than all 73 other countries surveyed, including Japan, the United State, and all EU countries surveyed, within which the maximum proportion was 11 percent.^{lxxviii}

Experimental (and often competitive) policymaking

African countries, as very diverse sovereign states, will naturally experiment with a range of different policy approaches. Though they can learn from one another’s policies, including between Africa’s sub-regions (e.g., through regional bodies such as the Economic Community of West African States [ECOWAS] and the East African Community ([EAC]), this may not be as straightforward as it is for

different provinces within China. Furthermore, *within* African countries, and with appropriate decentralisation, much like in China, municipal/city-based, county, or provincial administrative divisions could also experiment and compete—if they have sufficient policymaking and financial decentralisation. Competition domestically can enable central governments to more easily discover and promote good innovation policy approaches. However, this approach will yield greater benefit in larger African countries; for instance, there is more room for experimentation within Nigeria, Ethiopia, Kenya, or the DRC, than in Equatorial Guinea, Lesotho, Rwanda, or the Gambia.

Huge domestic market and economies of scale

Domestically, no single African country has a potential market of the scale of China's, meaning the huge domestic economies of scale available with relative ease to innovating enterprises in China are not available to equivalent enterprises in Africa.

However, larger countries, such as Nigeria, which is forecast to have a population over 400 million in 2050, will still have great potential for domestic economies of scale relative to the vast majority of countries in the world, so this similarity must not be discounted outright.

Furthermore, regional bodies such as ECOWAS and the EAC, with more streamlined regional economies, could help broach this problem for smaller countries (and also benefit larger countries), alongside the AfCFTA.

High spending on R&D and human capital

All African countries can use this feature of the “China model.” Expanding access to (primary, secondary, and tertiary) education, and spending more on R&D would open up innovative capacity among their populaces.

Given this context, what can be recommended going forward?

5. CONCLUSIONS AND RECOMMENDATIONS

This paper has explored the conventional economic theory of intellectual property and set out how China's innovation and IP policies in practice have been different to that conventional economic theory, while nevertheless delivering overall economic growth and innovation. The paper highlights the specific ways in which China has done so—and in so doing challenged certain tenets of classical economic theory.

The paper has explored how relevant China's IP and innovation experience could be in African and other developing countries, reviewing Africa's own trajectory so far on IP and innovation, and highlighting a total of six key similarities and three key differences between African and Chinese economies and policies currently in place, and analysing specific implications of the abovementioned differences.

Our overall view having conducted this analysis is twofold. First, China demonstrates that the conventional “Arrow-based” theory of intellectual property need not be stringently applied in order to generate economic gains. Second, in contexts like China's and, we contend, many of those in African countries, stringently applying this theory could, in fact, become a significant hindrance to innovation and, therefore, to economic growth.

However, the three current differences we identify between Africa's and China's situation are fairly fundamental. If African governments were to take seriously the potential to follow China's model, a number of major changes would need to take place. However, by undertaking this novel analysis, our intention is to, at the very least, open up the potential for African stakeholders to draw from China's approach to intellectual property, while tailoring it to their own economic situation and ambitions.

Based on this analysis, we provide three specific sets of recommendations for various governmental level stakeholders who are interested in encouraging growth and innovation in African economies, including through innovation policy as well as trade and other tools.^{5,4} We set these out below.

Recommendations for relevant international and African organizations, including WTO and African regional bodies

1. The WTO (in particular, TRIPS) and WIPO

The fact that the majority of African countries have already acceded to the WTO presents a major challenge to their ability to make the most of open innovation for their growth, and therefore emulate China's experience. We recommend that the WTO initiate, as soon as possible, a process to explore the implications of open innovation models for African and other low- and middle-income countries' TRIPS compliance, with a view to reconsidering the enforcement of IP in these economies. In addition, the WTO should initiate a discussion on how African governments can create incentives to integrate SMEs, special economic zones, and innovation hubs to help push towards a "Shenzhen model" for Africa. This work could be conducted in partnership with WIPO.

2. African Continental Free Trade Agreement (AfCFTA) leaders and secretariat

As part of the AfCFTA's forthcoming mandate for harmonisation, there will be work undertaken in relation to intellectual property. Specifically, this takes the shape of the IP Protocol, which forms part of the second phase of AfCFTA negotiations, intended to be completed by June 2021. We recommend that, drawing from China's experience, the AfCFTA keeps open the possibility of NOT harmonising in the direction of strengthening existing IP standards, and instead encouraging a fuller discussion of what is absolutely necessary at the level of Africa's industrialisation. Beyond this, all continued work to standardise the continental market and allow for free movement of goods with and without IP is crucial, so as to allow for economies of scale, exchange of information and IP across the continent. This should include the harmonisation of ARIPO, OIPA and other IP national and regional IP bodies. It is important that IP does not create new tariff barriers (for example, akin to rules of origin). Finally, the AfCFTA should also design rules to encourage African governments to utilise SME funds and other relevant instruments to create incentives to integrate SMEs, special economic zones, and innovation hubs to help push towards a "Shenzhen model" for Africa.

5 While it would also be possible to set out recommendations for businesses and investors, we take the view that businesses and investors respond to structures, policies and incentives, and therefore in this paper we prioritize those who can change such structures.

Recommendations for African governments looking to support innovation development

1. Use existing flexibilities in the current regime

The conventional theory that strong IP laws and enforcement drive innovation and growth is being challenged—including based on the experience of the now second-largest economy in the world. Should governments find themselves in situations where they can use existing flexibilities in WTO rules to enable international technology/information transfer and/or open innovation in various domestic industries, we recommend they seriously consider doing so. The recent proposal by India and South Africa to temporarily waive certain TRIPS obligations for the prevention, containment, and treatment of COVID-19 is an example of an approach to bringing more flexibility to WTO rules.

2. Use existing national patent laws to prevent successful registration of weak patents/maximize opportunity to contest patents

In its growth strategy, China's took the view that domestic registration of certain important and/or weak patents from domestic/international partners could be a growth hindrance. Based on the findings in this paper, while African governments are already constrained to some degree by accession to WTO, they can nevertheless be mindful, and for each patent registration request, conduct an assessment of the potential impact domestically—including based on the country's development plan. This should ideally be made public to support understanding and awareness of this issue by citizens, business and international partners. If international and national laws allow it, flexibilities should be used to prevent/contest those patents that are projected to have a negative impact.

3. Promote the development of a knowledge commons

China's experience indicates that at some level over the past decades, its government was concerned that IP could inhibit open innovation and/or the growth of a nascent domestic industry or “essential” product for local citizens. Again, while African governments are already constrained to some degree by accession to WTO, African governments could consider making a case for openly creating a “knowledge commons”—i.e., limiting patentability for a key set of innovations domestically or in the African region that are deemed key to meet certain United Nations Sustainable Development Goals (e.g. SDG 9 on innovation and infrastructure, SDG 3 on health, etc.). This could be akin to the way South Africa claimed a “national emergency” in the 1990s in order to ensure access to certain HIV/AIDS drugs that were otherwise subject to international IP law.

4. Encourage and invest in linkages between SEZs and innovation hubs

This paper has shown that African governments are already investing in SEZs, while African businesses and investors are investing in innovation hubs. China's “trick” in Shenzhen was to combine these trends into one, and ensure government and business complement each other to drive innovation. The next step in at least a few African SEZs—perhaps those that are most diversified as well as developed—is to do the same as Shenzhen and pilot their evolution into open innovation hubs.

5. Promote alternative mechanisms at WTO and other international institutions

This paper demonstrates that the relationship between IP rights, innovation, and growth is not as simple as conventional economics might suggest. Indeed, there is no “one path” to development. Experience of countries such as China implies an alternative model. Thus, in international settings—including

WTO, WIPO—African negotiators and representatives should be mindful to allow for various potential relationships to emerge through the international laws and conventions they create and avoid being boxed into one economic or development model that may not work for their interests and ultimate poverty reduction and sustainable development goals.

Recommendations for China and other development partners looking to support innovation development in Africa

1. Keep public-interest and publicly funded innovation in the public domain, everywhere

In the past, non-African firms and governments have been a significant barrier to utilising IP flexibilities in African countries to support development, in particular when it comes to global health (e.g., HIV/AIDS medicines, COVID-19 vaccines, etc). This paper—outlining China’s positive experience of growth with open IP—provides a further argument to widening such circumstances beyond “national emergencies” to enable openness to generate sustainable development. In particular, where, for instance, taxpayer finance has been used in one jurisdiction to subsidise development of a new innovative product, on the basis that it is a “global public good.” it may well be distortionary to then create barriers to innovating on that product elsewhere through IP law enforcement in another jurisdiction.

2. Promote alternative mechanisms and flexibilities

If international partners, including China, are truly looking to support innovation and economic growth in African countries, it is important to recognise that strong IP laws and enforcement may not be in developmental interests, at least at earlier development stages. Thus, international partners should, where relevant, encourage their (often multinational) firms to act flexibly, and during international negotiations either promote or at least be open to using or creating new alternative mechanisms and flexibilities that allow for open innovation. This could include the development of a knowledge commons for African countries for key developmental industries or products, as well as further discussion of TRIPS flexibilities.

3. Direct more financial support (e.g., loans, foreign direct investment) towards integrated innovation and industrialisation plans

The Shenzhen model in China demonstrates that open innovation and industrialization can go hand in hand. Supporting interested African governments and businesses, including SMEs, to experiment with this model could be transformational.

ENDNOTES

- ⁱ https://www.wipo.int/pressroom/en/articles/2020/article_0005.html
- ⁱⁱ https://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=NG
- ⁱⁱⁱ UN General Assembly, *Transforming our world: the 2030 Agenda for Sustainable Development*, 21 October 2015, A/RES/70/1, available at: <https://www.refworld.org/docid/57b6e3e44.html> [accessed 16 July 2020]
- ^{iv} African Union Commission. (2014). *On the Wings of Innovation: Science, Technology and Innovation for Africa, 2024 Strategy (STISA-2024)*. AUC, Addis Ababa.
- ^v African Union Commission. (2015). *Agenda 2063*. The African Union Commission.
- ^{vi} See <https://www.ideatovalue.com/inno/nickskillicorn/2016/03/innovation-15-experts-share-innovation-definition/> for 15 “innovation experts” varied definitions of the term.
- ^{vii} Abramovitz, Moses. “Resource and output trends in the United States since 1870.” *Resource and output trends in the United States since 1870*. NBER, 1956. 1–23.
- ^{viii} Rosenberg, Nathan. “Innovation and economic growth.” *Innovation and Economic Growth* 52 (2004).
- ^{ix} Pece, A. M., Simona, O. E. O., & Salisteanu, F. (2015). Innovation and economic growth: An empirical analysis for CEE countries. *Procedia Economics and Finance*, 26, 461–467.
- Sesay, B., Yulin, Z., & Wang, F. (2018). Does the national innovation system spur economic growth in Brazil, Russia, India, China and South Africa economies? Evidence from panel data. *South African Journal of Economic and Management Sciences*, 21(1), 1–12.
- Saleem, H., Shahzad, M., Khan, M. B., & Khilji, B. A. (2019). Innovation, total factor productivity and economic growth in Pakistan: a policy perspective. *Journal of Economic Structures*, 8(1), 7.
- Shukla, Sushma. “Innovation and economic growth: A case of India.” *Humanities & Social Sciences Reviews* 5.2 (2017): 64–70.
- ^x Morck, Randall, and Bernard Yeung. *The economic determinants of innovation*. Vol. 25. Industry Canada, 2001.
- ^{xi} https://www.wipo.int/pressroom/en/prdocs/2003/wipo_pr_2003_337.html
- ^{xii} Agreement, W. T. O. (1994). Marrakesh Agreement Establishing the World Trade Organization. *Multilateral Agreements on Trade in Goods*, Annex A, 1.
- ^{xiii} TRIPS: Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299, 33 I.L.M. 1197 (1994) [hereinafter TRIPS Agreement].
- ^{xiv} World Trade Organization, Ministerial Declaration of 14 November 2001, WTO Doc. WT/MIN(01)/DEC/1, 41 ILM 746 (2002) [hereinafter Doha Declaration].
- ^{xv} <https://www.ip-watch.org/2008/07/07/intellectual-property-regime-stifles-science-and-innovation-nobel-laureates-say/>
- ^{xvi} C. Armstrong, J. de Beer, D. Kawooya, A. Prabhala, and T. Schönwetter, *Access to Knowledge in Africa: The Role of Copyright* https://www.wipo.int/wipo_magazine/en/2011/01/article_0009.html
- ^{xvii} Nordhaus, William D. 1969. *Invention, Growth and Welfare*. MIT Press
- ^{xviii} Morck, Randall, and Bernard Yeung. *The economic determinants of innovation*. Vol. 25. Industry Canada, 2001.
- ^{xix} Levin, Richard C.; Klevorick, Alvin K.; Nelson, Richard R.; Winter, Sidney G. 1987. *Appropriating the Returns from Industrial Research and Development*. Brookings Papers on Economic Activity. 783–832
- ^{xx} Morck, Randall, and Bernard Yeung. *The economic determinants of innovation*. Vol. 25. Industry Canada, 2001.
- ^{xxi} Foege, J. Nils, et al. “Reconceptualizing the paradox of openness: How solvers navigate sharing-protecting tensions in crowdsourcing.” *Research Policy* 48.6 (2019): 1323–1339.
- ^{xxii} Baker, D., Jayadev, A., & Stiglitz, J. E. (2017). *Innovation, intellectual property, and development: A better set of approaches for the 21st century*.
- ^{xxiii} These 14 countries are Central African Republic, Comoros, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Guinea-Bissau, Libya, Niger, Sao Tome and Principe, Somalia, South Sudan, Sudan, and Togo.
- ^{xxiv} Pugatch & Torstensson, 2019
- ^{xxv} Pugatch & Torstensson, 2019
- ^{xxvi} Angola, Central African Republic, Comoros, Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Gabon, Guinea-Bissau, Libya, Sao Tome and Principe, Somalia, South Sudan, and Sudan.
- ^{xxvii} <https://databank.worldbank.org/indicator/NY.GDP.PCAP.CD/1ff4a498/Popular-Indicators>
- ^{xxviii} Yip, G. S. and McKern, B., 2016. *China's Next Strategic Advantage: From Imitation to Innovation*. MIT Press.
- ^{xxix} <http://en.people.cn/n3/2019/1103/c90000-9628827.html>
- ^{xxx} Fu, X. and Xiong, H. (2011), “Open innovation in China: policies and practices,” *Journal of Science and Technology Policy in China*, Vol. 2 No. 3, pp. 196–218. <https://doi.org/10.1108/17585521111167243>
- ^{xxxi} <https://www.wipo.int/edocs/lexdocs/laws/en/cn/cn028en.pdf>
- ^{xxxii} Torremans, P., Shan, H. and Erauw, J. eds., 2007. *Intellectual property and TRIPS compliance in China: Chinese and European perspectives*. Edward Elgar Publishing.
- ^{xxxiii} <http://english.mofcom.gov.cn/aarticle/lawsdata/chineselaw/200211/20021100050884.html>
- ^{xxxiv} <https://www.wipo.int/edocs/lexdocs/laws/en/cn/cn006en.pdf>

- ^{xxxv} http://www.chinadaily.com.cn/bizchina/2006-04/17/content_569573.htm
- ^{xxxvi} Côte d'Ivoire, Eswatini, Gabon, Ghana, Kenya, Mauritius, Morocco, Namibia, Nigeria, Senegal, South Africa, Tanzania, Uganda, and Zambia
- ^{xxxvii} China Ex-Im Stats from WITS, China Patent Stats from WIPO
- ^{xxxviii} China Ex-Im Stats from WITS, China Patent Stats from WIPO
- ^{xxxix} https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1196062
- ^{xl} <https://ieeexplore.ieee.org/abstract/document/6114625>
- ^{xli} Mercurio, B., 2012. The protection and enforcement of intellectual property in China since accession to the WTO: Progress and retreat. *China Perspectives*, 2012(2012/1), pp.23–28.
- Volper, T.E., 2007. TRIPS enforcement in China: A case for judicial transparency. *Brook. J. Int'l L.*, 33, p.309.
- ^{xlii} <https://www.scmp.com/business/companies/article/2118788/shenzhen-chinas-most-innovative-city-says-hsbc>
- ^{xliii} <https://www.ft.com/content/2c38ccb8-0ad8-11e6-b0f1-61f222853ff3>
- ^{xliv} <https://ieeexplore.ieee.org/document/5302866>
- ^{xlv} http://www.chinadaily.com.cn/bizchina/2017-12/05/content_35211989.htm
- ^{xlvi} https://www.jstage.jst.go.jp/article/irpsd/4/4/4_27/_article
- ^{xlvii} <https://www.npr.org/sections/money/2015/11/27/457404184/episode-666-the-hoverboard-life>
- ^{xlviii} E.g. see: <https://www.project-syndicate.org/commentary/china-poverty-reduction-reinforces-rct-doubts-by-yuen-yuen-ang-2019-11>
- ^{xlix} <https://www.sciencemag.org/news/2020/08/china-again-boosts-rd-spending-more-10>
- ^l <https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=CN>
- ^{li} https://oecdobserver.org/news/fullstory.php/aid/3781/China:_Investing_in_human_capital.html
- ^{lii} <https://monitor.icef.com/2019/07/more-than-eight-million-graduates-from-chinese-universities-this-year/>
- ^{liii} <https://www.globalinnovationindex.org/gii-2020-report>
- ^{liiv} <https://www.forbes.com/sites/tobyshapshak/2019/10/30/africa-now-has-643-tech-hubs-which-play-pivotal-role-for-business/>
- ^{liv} <https://www.cio.com/article/3528790/are-african-tech-hubs-really-helping-innovation.html>
- ^{lvi} For more details and a discussion of these reasons see p. 11, UNDP & IPRCC, 2015: <https://www.cn.undp.org/content/china/en/home/library/south-south-cooperation/if-africa-builds-nests--will-the-birds-come-.html>
- ^{lvii} https://unctad.org/system/files/official-document/WIR2019_CH4.pdf
- ^{lviii} <https://www.pewresearch.org/fact-tank/2020/04/22/populations-skew-older-in-some-of-the-countries-hit-hard-by-covid-19/>
- ^{lix} <https://www.weforum.org/agenda/2019/08/youngest-populations-africa/>
- ^{lx} <https://www.citiesalliance.org/newsroom/news/cities-alliance-news/burgeoning-africa-youth-population-potential-or-challenge>
- ^{lxi} <https://www.statista.com/statistics/232265/mean-age-of-the-chinese-population/>
- ^{lxii} <https://data.worldbank.org/indicator/SE.SEC.ENRL?locations=ZG>
- ^{lxiii} <http://documents1.worldbank.org/curated/en/109901592405885723/COVID-19-Impact-on-Tertiary-Education-in-Sub-Saharan-Africa.pdf>
- ^{lxiv} <https://techcabal.com/2020/07/02/mobile-payments-in-nigeria-have-grown-391-in-1-year/>
- ^{lxv} <https://news.yahoo.com/stripe-acquires-nigerias-paystack-200m-122251682.html>
- ^{lxvi} Women and men in the informal economy: a statistical picture, 2018, International Labour Organisation
- ^{lxvii} https://www.wto.org/english/news_e/pres20_e/pr865_e.htm
- ^{lxviii} <https://inventa.com/en/news/article/532/patent-applications-in-the-african-continent-having-origin-in-china>
- ^{lxix} <http://uis.unesco.org/en/news/new-uis-data-sdg-9-5-research-and-development-rd>
- ^{lxx} <http://www.mckinseychina.com/wp-content/uploads/2015/07/mckinsey-china-effect-on-global-innovation-2015.pdf>
- ^{lxxi} https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/INTRA%20AFRICAN%20TRADE_INTRA%20AFRICAN%20TRADE.pdf and <https://au.int/en/documents/20200213/african-innovation-outlook-iii> PDF
- ^{lxxii} ARIPO Secretariat. (2018). ARIPO: Who We Are and What We Do. Retrieved 2021, from https://www.aripo.org/wp-content/uploads/2018/12/ARIPO_Who_We_Are_What_We_Do_1-1.pdf
- ^{lxxiii} Statute of the Pan African Intellectual Property Organization (PAIPO), 2016, https://au.int/sites/default/files/treaties/32549-treaty-0053_-_paipo_e.pdf
- ^{lxxiv} Status list: Statute of the Pan African Intellectual Property Organization (PAIPO) <https://au.int/sites/default/files/treaties/32549-s1-STATUTE%20OF%20THE%20PAN%20AFRICAN%20INTELLECTUAL%20PROPERTY%20ORGANIZATION%20%28PAIPO%29%20%281%29.pdf>
- ^{lxxv} Ghana's President Nana Akufo-Addo Says Ghana will no Longer Export Cocoa to Switzerland, 2021, Displore, <https://www.youtube.com/watch?v=DbvocKxDtSc> (8:10–8:30)
- ^{lxxvi} Mobile financial services in Africa: Winning the battle for the customer, 2017, McKinsey, <https://www.mckinsey.com/industries/financial-services/our-insights/mobile-financial-services-in-africa-winning-the-battle-for-the-customer>
- ^{lxxvii} Africa's Mobile Money Boom, 2020, Forbes, <https://www.forbes.com/sites/ilonalimonta-volkova/2020/12/07/mobile-money-in-africa/>
- ^{lxxviii} How Common is Crypto?, 2021, Statista, <https://www.statista.com/chart/18345/crypto-currency-adoption/>



WWW.CGDEV.ORG

This work is made available under the terms of the Creative Commons Attribution-NonCommercial 4.0 license.

This note was commissioned by CGD with authors from Development Reimagined.

PETER GRINSTED is an economist at Development Reimagined.

OVIGWE EUGENE is a policy analyst at Development Reimagined.