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## **POTENTIAL AND PITFALLS FOR AFRICAN INDUSTRIALIZATION IN CHINESE-BUILT STANDARD GAUGE RAILWAYS**

Yunnan Chen

*Railway development has been a key feature of transport infrastructure investments in several African economies, with several new standard gauge railways (SGR) built in the last ten years in Ethiopia, Nigeria, and Kenya. These planned projects have also entailed substantial Chinese involvement through construction contractors, in financing, and in the operations and management, becoming part of the wider Chinese discourse of the Belt and Road Initiative (BRI). They also have significant potential in supporting the industrialization plans of African states, and in some cases, have been explicitly linked to plans for a green transformation. This brief draws from case studies across Africa with a focus on Ethiopia, to highlight the significant potential of railway investments as a low-cost, low-carbon transport for green industrialization, but also its pitfalls and challenges as an infrastructure for governance, and local technology transfer.*

### **1. The booms of Chinese overseas finance in Africa**

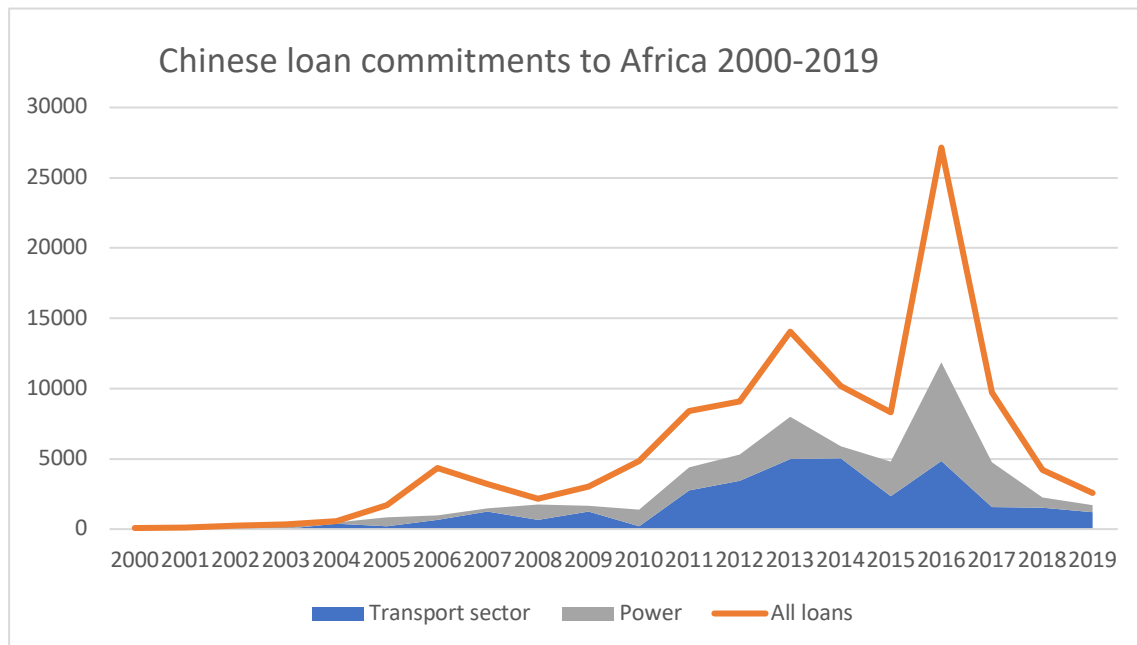
China has become one of the most important financiers of infrastructure investment in Africa over the last decade. Following the global financial crisis, its overseas lending has seen a boom, and eventual bust in Africa and globally. This was a direct

consequence of its domestic economic investment, which saw a growing overcapacity and saturation in infrastructure markets at home. As well as large construction giants, smaller state-owned enterprises and private SMEs in manufacturing and services also saw growing waves of outward migration. Supported by China's major policy banks, this internationalization of Chinese capital and Chinese companies eventually coalesced under the label of the Belt and Road Initiative in 2013, focusing on connectivity infrastructure, and its potential to catalyze trade and economic development.

African markets have been key destinations for infrastructure construction and investment, particularly in transport – roads, railways and port projects. transport constitute under 30% of total committed lending from official Chinese creditors between 2000-2019, and transport and energy together just over 50% (CARI, 2020). Railway projects have largely been financed through packages of export buyers credits and tied to the procurement of Chinese equipment and to Chinese contractors, who have become dominant construction and engineering giants in African markets.

The **African Industrial Policy in the 21st Century (AIP21)** network brings together scholars to share research results and outline a new research agenda in view of developing new thinking for a green and resilient industrial policy in Africa for the 21st century. The AIP21 Network organized a series of workshops in 2022 on green industrialization in Africa at Copenhagen Business School and the University of Johannesburg in South Africa, with co-funding from DANIDA's Knowledge in Action grant. These policy briefs are some of the outputs from the workshops.

Railway construction is also considered a strategic sector for the export of Chinese technology, in what has been called an ‘supply chain export’ strategy, where the building of SGR rail entails the use of Chinese locomotives designed for SGR across the network, Chinese signalling and equipment (Ker, 2017). The supply of Chinese finance and technology ‘going out’ coincided with growing African demand, and the transformation strategies and industrialisation ambitions of African governments.



**Figure 1: Trends in Chinese lending in Africa in selected infrastructure sectors (source: China Africa Research Initiative)**

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technology ‘going out’ coincided with growing African demand, and the transformation strategies and industrialisation ambitions of African governments.

## 2. Railway in Africa's economic transformation

Railways have long been part of African growth strategies, and in plans for national and regional economic corridors, particularly in the case of developmental states such as Ethiopia (Clapham, 2018), but also part of wider plans in the East African Community. Over this period, African states have leveraged Chinese financing to support desired infrastructure investment, across multiple sectors.

In Nigeria, under former President Obasanjo, a 25-year strategic vision had been designed to overhaul the railway sector. To do so would need partnerships with international donors and foreign

companies, to rehabilitate its colonial-era railways, and to expand them into a national network. Eventually the government selected the Chinese contractor China Civil Engineering and Construction Corporation (CCECC) to construct a new railway trunk line from Lagos to Kano: this began with the Abuja-Kaduna line, financed through a 500mn preferential export credit from China Eximbank, and a subsequent but non-coterminus Lagos-Ibadan segment, financed through a 1.3bn USD Eximbank loan (Olurounbi & Clowes, 2022). In Kenya, the Madaraka express – a new standard gauge railway line that followed and replaced the old British colonial “lunatic express” railway from Nairobi to Mombasa, with an extension to Naivasha, and originally planned to extend to the Ugandan border as part of a broader East African railway. This was funded through a total of 4.7bn in lending from China Eximbank, through a mix of concessional and commercial buyers credits (Taylor, 2020).

Ethiopia utilised Chinese financing to support the development of domestic plans for structural transformation, under the Growth and Transformation Plan (GTP I and II), which saw railway as a key component in lowering the cost of freight from the inland industrial zones to the port connection at Djibouti, thus supporting the country’s export-oriented industrialisation strategy. Constructed by CREC and CCECC between 2011-2016 and financed through a \$2.5bn loan from China Eximbank, the first trunk line from Addis Ababa to the Port of Djibouti was completed in 2016 and started commercial operations in 2018.

In Ethiopia’s case, rail was also seen as an integral part of a low-carbon development model. The railway lines were designed to be fully electrified along the route, enabling it to be powered by ‘cleaner’ energy sources, and making use of the country’s significant hydropower capacity. However, this also meant that the railway lines were dependent on the completion and operation of a stable power transmission network, which has led to substantial teething problems in commission and operation (Chen, 2021).

## ***2.1 Industrialisation and green transformation***

Infrastructure investments are not necessarily profitable, but their rationale is based on their wider catalytic impact for the economy. Railways have a lower per-unit cost for freight shipping, making it advantageous for bulk goods and long-distance transport. Through lowering the economic and transaction costs of logistics, rail and other forms of transport infrastructure can boost the competitiveness of domestic firms and export sectors.

Rail can also contribute to long-term structural transformation. By facilitating the development of industrial zones and sectors, and in raising the technical capacity of domestic actors and institutions, railways can help support the economy to move from agricultural and primary sectors to value-added and higher-productivity industries. This has been a key rationale in the railway: to support the Growth and Transformation plan through promoting industrial development and exports—through which the cost of the railway would be recovered—as well as stimulating broader economic investment.

In the case of Ethiopia, the railway network design and location were intended to connect major industrial zones around Addis Ababa (including the large Chinese-initiated zones such as the Eastern Industrial Zone and Bole Lemi Industrial Park), as well as other zones around Dire Dawa, Adama and in the North around Mekele and Kombolcha. However, the last mile costs for exporting firms to load their goods onto the railway, via designated dry-ports, as well as its less flexible schedule, makes railway still insufficiently attractive compared to trucking. The line has been successful to an extent in stimulating industrial zone development, most notably in the construction of new industrial zones around Dire Dawa by one of the Chinese contractors, indicating a longer-term transformative potential for railway development in attracting foreign investment, and particularly investment from Chinese firms.

As an electrified railway, the Addis-Djibouti line also serves a broader ‘green’ development vision, which would reduce the countries dependence on fossil fuels in transportation, and be a cleaner, less

polluting form of transport. However, in practice, this was a highly questionable decision. It also went against the advice of the contractors and external experts, due to the greater risks and fragility that an electrified railway would entail. While an electrified railway is theoretically lower in emissions compared to a diesel engine, it would still present a lower emission intensity alternative to road transport considering the potential freight and passenger volumes. Logistically, electrification also made the railway's commission dependent upon the development and installation of power transmission networks, as well as the capacity of available hydropower dams, which in turn had been affected by droughts in 2017—all of which led to delays in the line's commission and frequent breakdowns in its early operation (Chen, 2021).

## ***2.2 Technology transfer and other Spillovers***

One major feature of Chinese-financed railway in Africa, are the implications for technology transfers within the import of new technologies. Unlike a road or building, the operation and the long-term sustainability of railway infrastructure requires a long-term investment in a technical corps of staff in driving, maintenance, and upkeep of the railway, as well as a management bureaucracy. This was a crucial mechanism in the development of China's own historical railway bureaucracy and engineering capacity, and in the development of its 'indigenous' locomotive technology.

This domestic technical capacity is lacking in many African countries, where former railways and bureaucratic capacity in this area have dissolved over time. Following the completion of the major SGR lines in all three countries, Chinese SOEs and commercial actors have been involved far beyond the usual tenure of turnkey EPC projects, remaining on project in the operations and management (O&M) of the line itself, to ensure the eventual capacity building and handover of the railway management to domestic staff. This has taken place through university and training exchanges, and partnerships with Chinese universities including as Tianjin Railway University, Central South University, and Southwest Jiaotong University. While capacity building remains a challenge due to language barriers and lack of experience in local staff, localization of railway operations is slowly

occurring. In 2021, the first batch of Chinese-trained Ethiopian train drivers graduated, to take over driving of trains (Global Times, 2021).

However, while intra-firm channels of training and knowledge transfer existed, firm-level formal linkages through joint ventures, or local subcontracting, was rare. This was due in part to lack of domestic capacity, but also the short-term incentives of Ethiopian policy-makers, who prioritized faster completion of the trunk railway, resulting in a lack of pressure from government on contractors to localize. The nature of financing from Chinese creditors also entailed a high level of procurement from Chinese sources, which left little space for local contractors to be considered.

## **3. Challenges and barriers to uptake of railway**

Last mile costs and high transaction costs remain significant challenges to the uptake and catalytic purpose of newly built railways for wider industrialisation. While revenues in the Addis-Djibouti railway have been rising, freight cargo use remains highly uneven, with the vast majority of cargo (around 95%) on the railway dominated by imports coming in from the port, rather than exports going out.

Competition from the road sector remains strong, and last mile costs in moving goods onto the railway are too high to make it an attractive option to local firms based in industrial zones which are not directly connected to the line. The railway faces strong resistance from the shipping and logistics state monopoly; reforms to this sector have been slow to pass, which would help liberalise and generate greater competition, and promote greater complementarity rather than competition with the railway.

Security and governance are also long-term structural challenges. Prior to the breakout of civil war in Tigray region in Ethiopia, the railway had already been a site of grievance against the federal government, leading to blockades against the railway and disruptions to its operations. These reputational impacts have also dampened the attractiveness of the railway for passengers.

Finally, a major implication in railway investment is the cost of financing. Most of the new and rehabilitated railways in Africa have been constructed through the support of Chinese contractors and Chinese financing, which tends to offer slightly more favourable market rates. Nevertheless, railways are an extremely long-term investments which largely does not generate profits unless bulk freight goods volumes are sufficiently high. Large infrastructure investments can cause significant fiscal pressure for governments who may face high repayment costs for external financing before the economic gains of the infrastructure are realised, as evidenced in the continued debt distress situation in Ethiopia and Kenya (Carmody et al., 2021).

#### 4. Policy implications

**Domestic technical capacity and experience** is a critical factor in not only design and implementation of railway project design and construction, but also in the long-term operation. Knowledge transfer from Chinese contractors will remain a slow and limited process, which also entails a degree of long-term dependence on external expertise and equipment. Policymakers need to build in capacity building within every component of a project cycle, and build independent expertise and capacity in construction, design, and project management, and draw from multiple external sources to indigenize and develop their own operating procedures and standards.

**Support the independence of feasibility studies and decision-making** in considering design and approval of large infrastructure projects. The selection of standard gauge in many African countries was often the highest cost option, and widely considered unnecessary compared to rehabilitation of existing networks. Estimates of freight volumes were often highly inflated to support the economic rationale of projects. Lack of independent review and decision-making leads to greater likelihood of ‘white elephant’ projects, creating significant fiscal burdens for states.

**Railway is a complex network infrastructure** with high initial investment cost, but whose low-cost economic advantage comes from its economies of scale and its reliable functioning. Single or scattered lines hold little comparative advantage, and lines that are unreliable hold little advantage against road transport alternatives. Railway needs considerable long-term investment to expand beyond single lines into a network, and to ensure smooth governance and function. This is not always feasible in contexts where governance is poor or where local capacity is lacking. Railway can be considered as one of several forms of investment alternatives, alongside improved roads, or greening trucking and logistics sectors, for governments seeking to improve their transport and logistics infrastructure.

#### ABOUT THE AUTHOR

**Yunnan Chen** is a Research Fellow at ODI, London, in the Development and Public Finance program. Her work centres around the development finance architecture, development finance institutions, and the role of global China. In particular, she researches the role of Chinese development finance, overseas lending and debt architecture, as well as the role of national development banks and DFIs in Africa.

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