


## Reimagining China's Transportation Funding Investments in Africa in the Context of COVID-19

Transportation Research Record  
1–11  
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Transportation Research Board 2021  
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DOI: 10.1177/03611981211031228  
journals.sagepub.com/home/trr  


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### Abstract

Africa has not invested enough in its healthcare system, and China has been investing in and financing much of Africa's transportation system. Many African countries' fragile health and transportation systems have been further weakened by the COVID-19 pandemic. This literature review confirms the interdependence of the key functional areas of comprehensive development planning and the importance of building and maintaining a sound transportation infrastructure. With respect to partnerships with China, African nations need to strengthen government functional areas more comprehensively, considering all of the areas of development planning including trade as well as transportation and aid issues. It is all the more apparent given the COVID-19 pandemic that these trade deals need to include simultaneous heavy investments in healthcare, education, housing, public utilities (water and electricity), and economic development through improved supply chain management and the use of advanced digital technology. In addition to the deal structures for China's investments in Africa's transportation infrastructure, there are also opportunities to reimagine the African nations' internal transportation spending. For example, there are models in the United States for using transportation funds to invest in health clinics in transit stations. The COVID-19 pandemic has brought this issue to bear, and it is a problem that can be rectified with "comprehensive" development planning that takes into account all of the key functional areas of planning: healthcare, environmental protection, safety, education, housing, economic development, and transportation. Five recommendations follow the literature review and discussion.

Comprehensive functional areas planning has been used by states in the USA since the 1920s. The functional areas include planning for land use, zoning, housing, education, safety, economic development, environmental protection, and transportation (1). The most vulnerable among the poor can be caught in "poverty traps" that hamper the initial stages of development (2). Events during the COVID-19 pandemic have demonstrated that the functional areas of urban and rural comprehensive development and planning are interdependent. The USA's model for using functional area planning is recommended for poorer economies that are home to society's most vulnerable, and they will be hit hardest by the COVID-19 pandemic (3). Although the direct impact is on health, the indirect impacts are largely economic in scope, related to poverty, inequality, and food security. These areas are devastated by the stay-at-home orders, social distancing, and travel restrictions (4). In particular, healthcare and economics are closely reliant on transportation. Africa has not invested enough in its healthcare system and China has been investing in and financing much of Africa's transportation system.

The African continent has the fastest growing population and receives the least foreign direct investment of any emerging region except the Central-Asian transition economies (5). By 2050, Africa's 1.1-billion population is estimated to double. As per the International Monetary Fund (IMF) and World Bank, Africa is the world's second fastest growing continent primarily because of growth in the Sub-Saharan region (6–8). In addition, Africa is the fastest urbanizing region of the world (6). The University of Navarra's IESE Cities in Motion Index of urban indicators ranks the top five African cities as Cape Town, South Africa; Johannesburg, South Africa; Tunis, Tunisia; Nairobi, Kenya; and Casablanca, Morocco (9). Yet, as revealed in this literature review, well before the COVID-19 outbreak, many countries and regions in Africa were not doing well in the strategic

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planning areas of human capital, social cohesion, economy, governance, the environment, mobility and transportation, urban planning, international projection, and technology.

In a 2010 address to the Regional Committee for Africa, Dr. Margaret Chan, the Director General of the World Health Organization stated that “progress in Africa towards ...health-related goals has been perceptible, but slow.” Chan was referring to self-reports from African countries regarding the consequences of the 2008 financial crisis (10). According to the World Economic Forum (11), African economies weathered the 2008 financial crisis well. Yet, many of the countries that managed to escape the crisis unscathed managed to do so by being isolated from the global economy, financial, trade, and production systems (12, 13). Just as the 2020 COVID-19 pandemic overwhelmed the healthcare facilities in advanced countries, the COVID-19 pandemic may devastate Africa’s fragile health systems and economies. There is a shortage of ventilators and protective gear. Despite a 2001 pledge by the heads of states of 52 African countries to commit to spending 15% of their annual Gross Domestic Product (GDP) on health, healthcare funding has not been at the forefront of government spending in many African countries. Only Tanzania, Rwanda, Botswana, and Zambia met the target (14).

Besides the large healthcare infrastructure gap, Africa’s transportation infrastructure is also troublesome. Transportation infrastructure lowers costs of economic activity, which has widespread direct and indirect benefits for a society; for a survey see Straub (15). For example, Neubert of the Centre for Rural Development in Berlin advocated, in 2016, that in Zambia farmers need better transportation infrastructure and access to vehicles to get their produce to market (16). In 2010, Dr. Chan stated “[y]ou need roads, not only to transport goods to market. You need roads to extend health care to rural areas, to transport people in need of emergency care and to deliver medicines and vaccines” (10). Current transportation systems constrain the African continent’s economic and social development (17, 18).

This literature review is followed by recommendations for government functional areas that better deal with Africa’s evolving needs. Rather than investing heavily in transportation infrastructure, it is recommended here that Africa direct investments simultaneously in transportation, healthcare, and educational functional areas of development planning. Further, there is precedence for transportation funding to be used in other functional areas of planning. Policies on how to make use of transportation funding need to be established more comprehensively.

## Literature Review

This study is a literature review of Africa’s needs in transportation and interdependent functional areas of comprehensive development planning. The method for this study is the critically appraised topic (CAT). It is a type of literature review which summarizes research evidence organized around a research question. The goal is to critique the research and provide a statement of the relevance of the research results. CATs are primarily used by clinical practitioners in healthcare (19). There are five steps in writing CATs: (1) asking a focused and answerable question; (2) searching for the best available evidence; (3) critically appraising the evidence for validity and relevance to the practice area; (4) applying the results to professional practice; and (5) evaluating performance. The research question needs to be important to the health and well-being of the research subjects. In healthcare, the research question is focused on the Patients, Intervention, Comparator, and Outcome (PICO) (19).

Here, we are focusing on the health and well-being of Africans. In comprehensive development planning, interventions include policy development, policy implementation, strategic planning, and financial investments. The comparator intervention is China’s financial investments and loans focused on Africa’s infrastructure. Thus, with this study, the formulated research question is:

*With respect to the state of Africa’s healthcare resources, how does China’s investment in Africa’s transportation infrastructure compare with other interventions used in comprehensive development planning for a successful outcome given the added burden of the COVID-19 pandemic?*

Transportation infrastructure is known to have direct impacts on the transaction costs of trade (20), but has similar effects on access to and the provision of healthcare (21). Without roads and railway lines, Africa’s chances for economic growth and social prosperity remain poor. The African continent could achieve economic diversity and industrialization with the building of roads, railways, and ports (22). To this end, in 2006, at a China–Africa summit in Beijing, Chinese President Hu Jintao promised to provide additional funding for investment in Africa. In 2007, the China–Africa Development Fund was established for several investments including the expansion of transportation (17).

Cities that want to progress must secure a privileged place in the world by maintaining global outreach to improve their brand. They can gain international recognition with representation abroad (9). This was true of Beijing. When the Communist Party of China first came to power in 1949, it was virtually completely

unrecognized by other countries. China lobbied Africa extensively for recognition. Political commitments were repaid in concrete and steel as China started building railroads. In exchange, China is interested in African natural resources such as oil, cotton, manganese to produce steel, cobalt, and coltan for Chinese electronics. China is now Africa's biggest trade partner, with trade at \$200 billion per year (6).

China is building transportation infrastructure in 35 African countries, with a large concentration in Angola, Nigeria, and the Sudan. The largest deals have been in Nigeria, Gabon, and Mauritania. There is a commitment to build the Abuja Rail Mass Transit System and to rehab the Lagos–Kano line in Nigeria (23). Projects include the \$12 billion coastal railway in Nigeria; \$4.5 billion Addis Ababa–Djibouti railway in Ethiopia; and \$11 billion Megaport in Bagamoyo (6).

In the Sudan, China's Sinohydro Corporation was granted a \$300 million contract to construct roads. In the Democratic Republic of Congo, the Export-Import Bank of China pledged a \$9 billion loan to finance a rail system to connect mineral extraction industries and to develop the mining sector. In return, China would gain rights to extract up to 10 million tons of copper and 420,000 tons of cobalt. In Guinea, China needed aluminum and offered assistance with both roads and hospitals (23). According to the China Africa Research Institute, by 2018, the gross annual revenues from Chinese engineering and construction projects in Africa totaled \$48.84 billion (24). Chinese investment in infrastructure is filling the large gap and answers the unmet transportation needs of African countries (17).

However, in 2015, there were substantial commodity price crashes. In response, Uganda suspended construction of new roads. Herbert McCleod, a leading Sierra Leone economist, has stated that problems with commodity price crashes in copper and iron are caused by bad policies and management. He recommends using proceeds from mining to boost job creation and to construct roads (25). In 2015, African leaders took part in the Sixth Tokyo International Conference on Africa's Development (TICAD VI) in Kenya. The first priority for Africa's development was to achieve economic diversification and industrialization by investing in part in roads as a first priority. The second priority was to build a more resilient healthcare system. The healthcare urgency was made apparent with the 2014 Ebola virus outbreak. Guinea, Liberia, and Sierra Leone were unable to respond well to the Ebola epidemic. The third priority was to combat socio-economic instability and climate change with job creation and disaster risk management (26).

Thirty years ago, China was in a place similar to where Africa is currently with regard to Africa's inadequate

systems. Thus, China desires to help Africa with its development. In 2018, Beijing announced a \$60 billion African aid package. In October 2019, Beijing announced a \$1 Billion *Belt and Road Africa Infrastructure Development Fund* (6). Nevertheless, there is a lot of focus on China's landmark Merger & Acquisitions deals in Africa's energy and metals industries. These are strategic objectives of China to secure access to resources using China's capacity in construction and transportation. But, the debt financing is the real concern (5). There is concern that the China debt financing has a self-interested nature focused on extractions of Africa's natural resources, and there are concerns about the consequences of increasing indebtedness of African economies to China (22). Actual investment in China is much smaller than the debt-generating project financing. The investments are much smaller than colonizing European countries' historical investments in Africa (5). Debt problems include the fact that the \$4.5 billion Addis Ababa–Djibouti railway in Ethiopia ended up costing Ethiopia nearly a quarter of its total 2016 budget, and Kenya's Mombasa–Nairobi railway has gone four times over budget and cost Kenya 6% of its GDP. In 2012, the IMF found that China owned 15% of Africa's external debt (6).

Further, one consequence of the COVID-19 pandemic is that African countries are experiencing a reduction in demand for their commodities. According to the UN, "The COVID pandemic began to impact African economies ... well before it reached the shores of the continent. Among the factors were: falling demand from Africa's commodities; capital flight from Africa; a virtual collapse of tourism and air transport ... lockdowns and border closures" (27). COVID-19 is taking a toll on Africa's economy.

In addition, hundreds of millions of Africans lack access to healthcare and clean water for frequent handwashing and cleaning (28, 29). In Africa, even as the number of COVID-19 infections grows, there is nothing simple about washing your hands when you have extremely limited access to clean water. The problem is not just a problem for Africa. In 2019, WHO reported that worldwide 785 million people lack a basic drinking water service. A right to access water requires substantial investments in transportation and water treatment plant infrastructure (30). The UN Global Humanitarian Response Plan (GHRP) supports the installation of handwashing facilities in vulnerable places (31).

Non-containment of the virus poses a high risk to lower-income communities who rely on public transportation; do not have savings and must continue to work; cannot afford hygiene products; and live in large households or reside in informal settlements. One of the priority policy actions is to provide emergency relief for

emergency food distribution and transportation (32). There is also a need for concerted action for the world to come together during the COVID-19 crisis and assist with debt relief in the form of freezes and relaxed debt servicing (33).

In April of 2020, the World Bank Group recommended that countries in Africa should strive to maintain and expedite trade flows to secure access to medical goods, medical services, and food. They recommended that transportation and logistics services be supported to maintain cross-border and international value chains. In particular, maintenance along main trade corridors and ports was deemed essential in light of the fact that Africa has the highest number of landlocked countries in the world. These areas required continued access via both their regional and to global economy (34). Acquiring adequate transportation capable of emergency response is listed as a challenge in the Republic of Malawi's National COVID-19 Preparedness and Response Plan. Additionally, lack of related capacity for human, technical, material, and financial coordination is problematic. The Republic of Malawi recognizes how global disruptions such as border closures and travel restrictions in the medical and humanitarian supply chain lead to transportation delays (35). In Africa, there are generally inefficient and bureaucratic public sector supply systems and poor transportation systems (36).

According to the UN, "Lockdowns, curfews and reduced manpower due to physical distancing are affecting all stages of the supply chain from production and manufacturing ... to road and air transport" (31). Transportation restrictions include border closures and cargo movement limitations. The provision of essential personal protective equipment has been a challenge because of supply chain obstacles. "Insufficient funding severely limits the ability to plan for and negotiate contracts, and to roll out logistics services at the scale required to ensure the supply chain needs and timely transportation of critical cargo for the global response" (31). The World Food Programme (WFP) supply chain services directly serve the non-government organization (NGO) community that functions independently of government services. This community faces increasing restrictions that inhibit their ability to mobilize, position, and transport supplies and staff because of the curtailment of commercial transportation and cargo services (31). To achieve a reliable health and supply system, it is imperative that the system have the capability to forecast needs, procure, store, transport, and inventory medicines and medical devices (37, 38).

During the West Africa Ebola response, approximately half of the volume of cargo transported was on behalf of UN Partners. In April of 2020, a consortium of NGOs warned that without the supply chain services laid

out in the GHRP, NGOs will be forced to halt operations and pull out of critical response locations. The United Nations International Children's Emergency Fund (UNICEF) works with the UN to improve the lives of children and their families. In support of UNICEF and partners, COVID-19 support includes shared procurement services for specialized supplies (31).

Good health requires good diets; good diets require food. Food insecurity is a real concern in Africa. In East Africa, the pandemic is striking at a time when the region is fighting an ongoing locust outbreak and is recovering from the drought and floods of 2019. Food insecurity is alarmingly high, with more than 15 million people in the Integrated Food Security Phase classification "IPC phase 3" or above in Ethiopia, South Sudan, Somalia, and Kenya. IPC phase 3 is the crisis phase (31, 39). COVID-19 has resulted in slower global trade and a slow-down in the demand for and transportation of exports from Africa. Transportation for key imports is also an issue at ports and along transportation corridors. The African Union estimates that 20 million jobs are at risk. Labor shortages and transportation mobility issues disrupt the agri-food supply chains and increase food insecurity (40).

Many Africans risk becoming food insecure as a consequence of this crisis. It is important to prioritize agriculture by declaring it a critical sector that should not be interrupted by COVID-19-related measures. Farmers need support and food corridors need to be secured to ensure uninterrupted supplies and food security (27). Two recommendations for food security include: (1) designating the agriculture sector an essential economic activity that must continue regardless of pandemic-related emergency restrictions; and (2) establishing and protecting food supply corridors for transportation, especially in landlocked and island states. Solutions for food security require investments in transportation systems to boost production, and reduce post-harvest losses and volatility in the supply and price of food (27).

Further, it is recommended that no additional taxes and fees are imposed on transit traffic and that existing duties be reduced on medical supplies and food (34). Besides taxes, the pricing of medical services is also a concern. It has been argued that "healthcare is a human right" (41, 42). In South Africa, the government has enacted regulations for setting maximum prices on private medical services related to COVID-19 testing and treatment (41). Besides the pricing of medical services, the Republic of Malawi is concerned about increases in transportation fares related to emergency responses (35).

Another fiscal issue is the likelihood of increased prices on imports as a consequence of the disruption in the global supply chain. For example, in Kenya, the Port of Mombasa was significantly affected by the cancellation of 37 ships in March 2020 because of COVID-19.

Kenya imports 21% of its goods from China. Low supply of imports is predicted to result in increased prices for clothing, furniture, and electronics. In addition to logistics issues (related to transportation restrictions, stricter border checks, and quarantines of cargo shipping crews), some countries have restricted food exports (43).

With respect to healthcare, cross-border truck drivers are a high-risk COVID-19 carrier population (40). “Container clinics” along Africa’s transportation corridors were recommended by the World Bank Group. A lesson from the HIV/AIDS epidemic in Africa was that the disease spread along main transportation corridors. The establishment of “container clinics” by the Abidjan–Lagos Corridor Organization (ALCO) in West Africa proved to be helpful (34).

Although income inequality between countries has decreased since 1980, the benefits of economic growth have not been evenly distributed (44). Sub-Saharan Africa has fallen behind (4), and is woefully behind in healthcare services such as family planning and infant immunization (45). Further, without access to medicines, the African continent has suffered through the HIV/AIDS epidemic, tuberculosis, and malaria. Fifty percent of children under five who die of pneumonia, diarrhea, measles, malaria, tuberculosis, and HIV/AIDS are in Africa (36). There are also other chronic diseases such as diabetes, heart disease, and sickle cell anemia.

In 2020, de Soysa et al. tested two hypotheses: (1) whether equality in access to healthcare reduces the societal impact of health pandemics; and (2) whether healthcare equity should matter more than broad-egalitarian governance for reducing the harmful consequences of pandemics (46). Increased access to healthcare and stringent lockdown measures increases testing and decreases deaths. COVID-19 deaths decreased with increases in healthcare equity. Based on their findings, they recommend that governments pay more attention to ways that they can fight the spread of disease by expanding their health system capabilities (46). Given their findings, it would make sense to invest in healthcare before or alongside hefty investments in transportation infrastructure. The focus should never be shifted away from healthcare.

Further, only half of the population of Sub-Saharan Africa has access to electricity. In addition, over the past 20 years, road density in the region has declined. The digitalization of African economies can improve transportation systems (32). With regard to healthcare, for example, Malawi uses mobile phone digital technology to combat maternal deaths (47).

With respect to supply chains for healthcare and food, the Côte d’Ivoire government adopted an emergency response plan that includes supporting public entities in the transportation and port sectors to ensure continuity in supply chains (32). There are several artificial

intelligence (AI) applications addressing COVID-19 in use. However, to achieve a global impact, “large-scale data and model sharing, operational validation, and adaptation to local contexts are needed.” There is a need for more solidarity and cooperation and solidarity across borders and involvement of healthcare workers (48).

Patrice Matchaba, Head of Global Health and Corporate Responsibility at Novartis, advocates that digital healthcare technology from data analytics to AI can bridge the healthcare gap. For example, AI robotic drones can help tackle supply chain challenges (49). Firms are piloting the use of drones to deliver medications and medical supplies in remote areas of Africa (50). In Rwanda, where most of the population lives in remote villages, the government wants to skip straight to the use of drones to drop off blood to blood banks. Malawi is working with a British architectural firm to plan drone ports for the use of drone transportation to deliver HIV blood tests. However, there are skeptics who do not believe that these villages can leapfrog into relying on high-tech start-ups supported by Silicon Valley firms like Zipline in the USA when they lack other important basic technologies. The concern is that issues with taxation, engineering, fragmented markets, and dysfunctional basic infrastructure will thwart progress with the implementation of drones (51).

In addition, public health facilities in South Africa are overcrowded, which increases the chances of COVID-19 transmission (41, 42). During the 2014 to 2016 Ebola outbreak in West Africa, one tragic consequence of attempts to control the spread of the virus was that pregnant women were reluctant to seek maternity care in medical facilities because of fears of being exposed to the virus. It is estimated that with COVID-19, the same reluctance to get healthcare will result in 1.2 million child deaths and 56,700 maternal deaths (52). The London School of Hygiene and Tropical Medicine (LSHTM) weighed the benefits of continued routine infant immunization vaccination programs against the risk of infections in Africa. In its modeling, the LSHTM found that for each COVID-19 death, at least 34 and as many as 1,247 future deaths would occur from a range of diseases including measles, yellow fever, and polio (31). Jacaranda Maternity provides pregnant patients with specially licensed cab drivers that transport patients in need of care to the Jacaranda Maternity Hospital free of charge. In the Equatorial region of Southern Sudan, pregnant women could not access healthcare in time because of poor road conditions. They now have ambulances and roads with the help of the WFP supported by the Dutch government (52, 53).

Camels provide a novel system for transporting medical supplies and personnel in Kenya’s remote villages and underserved communities. Camel clinics are a

Communities Health Africa Trust initiative. Camel clinics comprise a team of 7–10 camels, a team of medical workers, and camel handlers. Uganda uses motorcycles to bring healthcare to remote areas. “In Samburu, like other areas in northern Kenya that are inaccessible due to nearly impassible roads, locals are forced to walk for hours to obtain urgent medical care. This has made the camel mobile clinics the most convenient means of providing health services” (47). In Kenya’s county of Turkana, motorcycle ambulances are in use. Motorcycles are used because they can navigate impassible roads to save lives, carry medicine, and help women who are in labor (47). In response to COVID-19, the UN GHRP supports the creation of new transportation hubs that facilitate the transportation of supplies by air travel. Medical supplies manufactured in Liege, Dubai, and China are being linked to regional hubs in Ethiopia, Ghana, and South Africa (31).

On reflection on these present-day conditions, we wonder what comes first, the chicken or the egg? In other words, what should be invested in first: roads or healthcare facilities? The China model worked well for China. Their investments in physical capital improved their trade and created jobs. The focus was on putting people to work first. Then there was more investment in human capital, including healthcare and educational systems (54). There is a Chinese proverb that says: “if you want to prosper, first build roads” (22). Should healthcare facilities be built first, before roads? Should roads be invested in first, as the China government advocates? Or should clinics be built along roads as the roads are built?

Although China advocates for the building of transportation infrastructure in Africa, note that health investments were a key part of China’s development story (55). World Bank Group President Dr. Jim Yong Kim has stated that “[i]nvestments in health, and more generally in people, are critical to build human capital and enable sustainable and inclusive economic growth” (45). It is necessary to simultaneously build transportation infrastructure and other functional areas of urban and rural planning such as healthcare, housing (i.e., with clean, running water), education, and environmental protection.

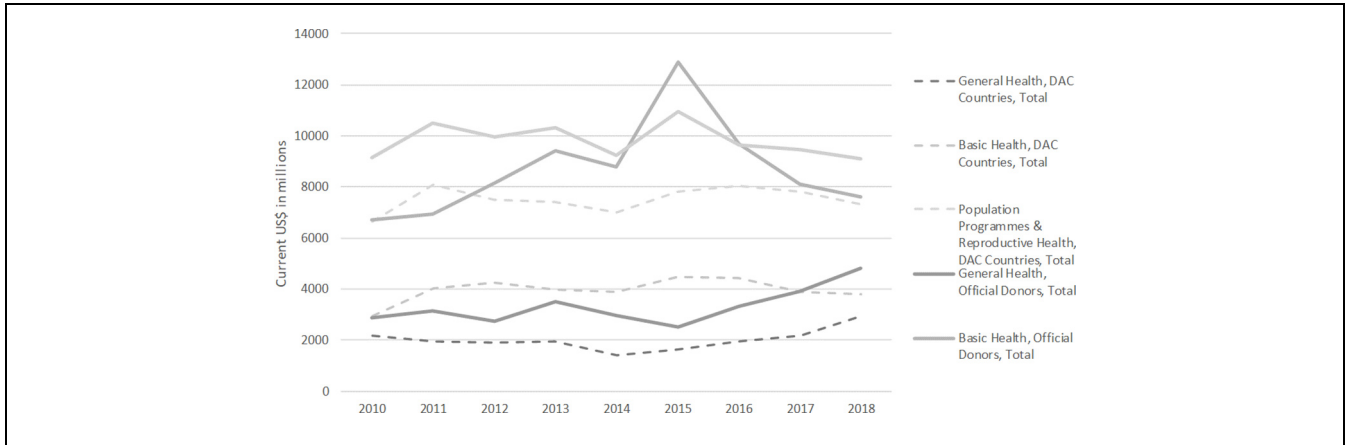
Why isn’t there more integrated development planning in Africa? The history of development planning has a first phase, from the 1960s to 1980s. Thirty-two African countries had national development plans. There was limited success because of poor planning documents, failure to implement plans, targets that were too ambitious, bureaucracy, “exogenous shocks,” and political factors (56). The second phase, from the 1980s to the 1990s, was marked by an abandonment of planning under Structural Adjustment Programs (SAPs). SAPs harmed social services because they focused on

downsizing the public sector and increasing privatization. The next phase began in the early 2000s with externally driven Poverty Reduction Strategy Programs (PRSPs). PRSPs were problematic and sometimes lacked credibility. Between 2003 and 2013 there was increasing interest in comprehensive development planning (56).

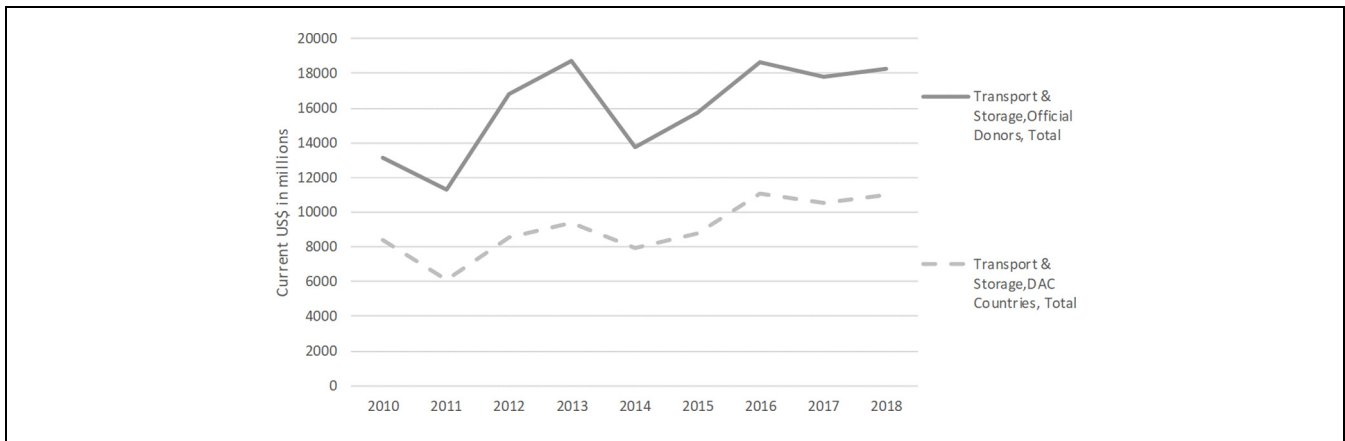
As per Chimhowu et al. (57), the first phase is back as there are now “new” national development planning efforts in over 130 countries focused on achieving Sustainable Development Goals (SDGs) priorities. The Chimhowu research team conducted 10 case studies, including six in Africa: Ghana, Togo, Tunisia, Uganda, South Africa, and Zimbabwe (57). Zambia has also moved from a sector-based approach to a more integrated development planning approach with a national development plan which integrates the SDGs, Disaster Risk Reduction, and climate action. Zambia was assisted by the United Nations Development Programme’s Regional Service Centre for Africa. Zambia was encouraged to develop a method and common framework for a practical comprehensive implementation plan (58).

Better governance is required for developing countries to overcome the obstacles that plague them, especially in Africa (2). By focusing on the most difficult development issues, the Millennium Development Goals (MDGs) and the SDGs represent efforts by the international community to directly address (and redress) the poverty and health problems that African countries face (59, 60). The MDGs included goals that would specifically increase official development aid from donor countries to Least Developed Countries and a clause to “meet the special needs of Africa.” The transformation into SDGs was meant to address the shortcomings of the initial goals and to expand the breadth of the goals by including sustainability and inclusivity. They also expanded the potential solutions to include support for infrastructure.

Private sector financing alone cannot overcome the barriers to infrastructure investment; thus, official development assistance (ODA) is a necessary component for development of health and transport infrastructure (61). When looking at the ODA provided by official donors and Organisation for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC), the levels of ODA for both health and transportation infrastructure have increased little over the past decade (see Figures 1 and 2). The differences in funding from official donors and the subset of DAC countries indicate the difference in priorities. DAC donors emphasize population programs over general/basic health and transportation. Notably, the difference in the DAC country share of investment in transportation infrastructure shrank after China announced the Asia Infrastructure Investment Bank in 2013. These changes in policy suggest that there is an opportunity to



**Figure 1.** Total official development assistance for health services, official and Development Assistance Committee (DAC) donors, 2010 to 2018 (62).



**Figure 2.** Total official development assistance for transport and storage, official and Development Assistance Committee (DAC) donors, 2010 to 2018 (62).

reimagine how African countries govern financing in these sectors.

**Discussion**

Rather than investing heavily in transportation infrastructure, it is better to simultaneously invest in transportation, healthcare, and educational functional areas of development planning. Policies on how to make use of transportation funding need to be established from a more comprehensive lens. In the United States, there is precedence for transportation funding to be used in other functional areas of planning, for example on resources other than roads and bridges. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) framework was flexible and took into consideration the health-related goals of air quality improvement, public safety,

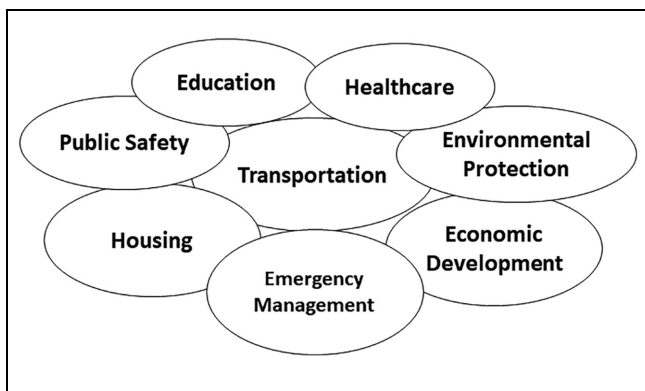
the health benefits of walking and biking, and equity for underserved populations (63).

ISTEA required planning with clear performance objectives, targets, and metrics. There has also been collaboration between the US Department of Transportation (US DOT) and the Center for Disease Control in America to develop recommendations for improving health through transportation policy (64, 65). In 2005, the Nonmotorized Transportation Pilot Program increased biking and walking (66). A 2012 US DOT-Volpe-funded study provides case studies and recommendations for metropolitan area transportation planning for healthy communities (67). The study notes how Massachusetts passed the Healthy Transportation Compact in 2009, which requires that public health impacts be considered during transportation decision making. This type of planning is also conducted by

Metropolitan Planning Organizations such as the Sacramento and San Diego council and association of governments. The emphasis is on air quality, bicycling, and climate action (67).

In 2016, the Federal Highway Administration unveiled its six-step Framework for Better Integrating Health into Transportation Corridor Planning (64). The steps include: (1) defining transportation problems and public health issues; (2) identifying transportation and health needs, resources, and priorities; (3) developing goals and objectives that promote healthy communities; (4) establishing evaluation criteria that include public health; (5) developing and evaluating alternatives and their health impacts; and (6) identifying alternatives that support health in communities. With respect to healthcare, there have also been clinics built by local governments with federal funding at public transit stations in the USA. For example, the City of St. Louis, Missouri received \$940,000 from the US DOT in 2016 to provide health check-ups to commuters. The US DOT provided \$7.3 million in grants for non-emergency healthcare to 19 communities (68). Similarly, in response to the need for COVID-19 virus testing, the City of Montreal Canada transformed some of its city buses into mobile testing clinics (69). Thus, there is precedence and models for simultaneously funding environmental enhancements and transportation, and healthcare and transportation.

There are eight functional areas of urban and rural comprehensive planning and development: (1) healthcare, (2) education, (3) housing, (4) economics, (5) public safety, (6) environmental protection, (7) transportation, and (8) emergency management (see Figure 3). Transportation is at the core of providing for the movement of people and goods that each of the other functional areas of comprehensive planning and development depend on. Opportunities exist for governments to act to simultaneously strengthen their healthcare systems,



**Figure 3.** Eight functional areas of urban and rural comprehensive planning and development.

transportation systems, and economies while also improving their resilience to the impacts of environmental climate change.

### Here are Five Recommendations

1. First, invest in cash for remote work as a social protection program.

The United Nations Food and Agriculture Organization has recommended that African Union member countries invest in expanding social protection programs by leveraging humanitarian funding. Social protection is predictable, uninterrupted social assistance benefits in the form of cash, work for cash, money for health expenses related to testing and treatment, and access to food (70). Remote work is a viable solution for African countries given their struggles with epidemics and the COVID-19 pandemic. During the pandemic, Kenya's government has encouraged teleworking (43). Also, creating remote jobs for women and youth is an important step toward not over-taxing the transportation system.

2. Invest heavily in population control using safe, protected sex education and birth control.
3. Build transportation systems that tackle climate change with the use of advanced technology.

The Southern Africa region has been affected in the recent past by growing climate-related shocks resulting in a record number of people being pushed into food insecurity (31). It is imperative to build sustainable transportation systems that combat climate change. In developing regions targeted for transportation infrastructure improvements, there is the opportunity to design sustainable and inclusive transportation systems by default and make use of technology such as AI and big data (71). Autonomous electric vehicles, autonomous air taxis, and drones are worth investigating. In addition, related advanced technology businesses should be encouraged to locate along high-tech transportation corridors (72).

4. Have disaster risk management plans that include transportation planning and supply chain management for the movement of goods and people.
5. Attempt to restructure existing infrastructure financing deals so that they address development plans comprehensively including healthcare issues and shocks, for example, COVID-19, and do not result in debt servicing that far outweighs benefits of transportation infrastructure construction.



## Conclusions

Africa has the fastest growing populations. Yet, African countries have not invested enough in their healthcare systems and China has been investing in and financing much of Africa's transportation system. Many African countries' fragile health and transportation systems have been further weakened by the COVID-19 pandemic. This literature review confirms the interdependence of the key functional areas of comprehensive development planning and the importance of building and maintaining a sound transportation infrastructure. With respect to their partnership with China, African nations need to strengthen their government functional areas from a more comprehensive lens, taking into consideration comprehensive development planning that includes sectors such as health and transportation. It is all the more apparent given the COVID-19 pandemic that trade deals need to include simultaneous heavy investments in healthcare, education, housing, public utilities (water and electricity), and economic development through improved supply chain management and the use of advanced digital technology.

In addition to the deal structures of China's investments in China's transportation infrastructure, there are also opportunities to reimagine the African nations' internal transportation spending. For example, there is precedence in the United States for using transportation funds in other areas of comprehensive development planning. Since the 1990s, the US has led the promotion of health in transportation policy and infrastructure. For example, there has also been funding for health clinics in transit stations. The US emphasis on comprehensive planning can benefit Africa, and the implication for US transportation professionals is that they should get more involved in helping developing countries. All too often strategic planners view transportation in a monolithic manner rather than advocating for the use of the funds to meet a community's needs comprehensively. The COVID-19 pandemic has brought this issue to bear. Future research should focus on the political economy, current practices and various methods to prioritize development projects, and issues with governance.

## Author Contributions

The authors confirm contribution to the paper as follows: study conception, design and literature review: C. Hamilton; data collection; analysis and interpretation of results; and draft manuscript preparation: C. Hamilton, S. Maliphol. All authors reviewed the results and approved the final version of the manuscript.



## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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