The impact of transport policies on road accessibility in Ghana (2010-2019)

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Abstract

This article examines the impact of transport policies on road accessibility in Ghana. To measure accessibility gains, the article applies a model that compares the area and population that can be reached in under four hours by road from any city in 2010 and 2019. By quantifying travel times required to reach the nearest city ten years apart, we measure whether road improvement projects have led to improving accessibility and in which regions of Ghana. The model suggests that regional disparities tend to grow as Ghana becomes increasingly urbanized. While major accessibility gains have been observed in the last decade, southern regions and cities have benefited more from the improvement and development of the road infrastructure than the rest of the country. Accessibility gains are particularly important in the southwestern part of Ghana, where mining, agriculture, and urbanization are fueled by new feeder roads in previously forested areas. By comparison, accessibility remains poor in the north of the country. The persistence of regional disparities is reinforced by the general distribution of the population in Ghana and the spatial structure of the urban network.

Keywords

Road accessibility, travel time, infrastructure, transport policies, Ghana, West Africa

Acknowledgments

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1. Introduction

Road accessibility has long been recognized as a critical factor in public policy. Accessibility policies contribute to better connect people that would otherwise be marginalized by their peripheral situation within the transport network, ultimately reducing vulnerabilities within urban agglomerations (Ng et al., 2017; Oviedo et al., 2022) and promoting national integration (OECD, 2019b). The emphasis on accessibility is particularly relevant in regions where population is sparsely distributed, cities are separated by long distances, and transport infrastructure is deficient, three conditions that characterize much of Sub-Saharan Africa (Porter, 2018).

The benefits of accessibility have led to a renewed interest in roads and other infrastructure projects on the continent that contrasts with the relative skepticism about transport that marked the era of structural adjustment in Africa (World Bank, 2010). International financial institutions, bilateral investors, and multinational companies heavily support this "re-enchantment with big infrastructure" (Nugent, 2018) fueled by a boom in primary commodity prices and the development of new technologies that can reduce trade frictions and corruption. The dominant paradigm behind this renewed interest is that an extensive road network provides timely and equal access to a wide range of social services, health infrastructure, and cultural amenities that would otherwise be out of reach for the population (Neutens, 2015).

While many studies have discussed the economic benefits of transport accessibility at the intra-urban (Campbell et al., 2019; Mittal et al., 2023) and continental level (Buys et al., 2010; Jedwab and Storeyard, 2022), the impact of transport policies on internal disparities within countries remains less documented. The objective of this article is to fill this gap by assessing the spatial impact of recent transport policies on accessibility in Ghana. We are particularly interested in understanding whether (1) transport policies have improved accessibility in general in the country and whether (2) such policies have managed to reduce existing disparities between the most populated and urbanized regions of the country and the least accessible areas. To analyze whether transport policies have improved accessibility and reduced regional disparities, we apply an accessibility model that measures the area and population that can be reached in under four hours by road from any city in 2010 and 2019, a period that covers the most recent transport plan.

Ghana is a particularly interesting case study to analyze the impact of transport policies on road accessibility. The country has a long history of centralized powers, particularly the Asante kingdom which had developed an extensive road network branching out from its capital city, Kumasi, by the late 19th century (Wilks, 1993). In the 20th century, the infrastructure demands of the gold mines and the cocoa sector reinforced the importance of road and rail routes linking Ashanti to the coastal ports. The importance of Sekondi-Takoradi as a port and the choice of Accra as the capital city ensured that much of the transport investments would be located in the far south. By contrast, little was spent on improving routes to the Northern Territories, which was regarded merely as a source of migrant labor. This had culminated in marked spatial disparities in accessibility by the end of the colonial period. Despite the best efforts of the

Nkrumah regime to integrate the north, uneven infrastructural development remained a deep-seated legacy.

More recently, Ghana's transport policies have consistently tried to reduce regional disparities, by developing or rehabilitating feeding roads and transport corridors across the country (GoG, 2020). Transport policies strongly emphasize the potential benefits of opening rural regions to market activities and connecting fast-growing cities to the West African and world markets. Improving accessibility beyond the capital city has also become an electoral objective since the return to constitutional rule in 1992. In a highly competitive political environment, where voters hold the government accountable for its performance in providing reliable roads (Harding, 2015), local communities frequently demonstrate against poor road conditions under the slogan "No roads, no vote' (Ghana Business News, 2023). For these economic and political reasons, one could also expect major transport investments to be spread out across the country, reducing existing disparities across regions.

2. Literature review

Investment in road infrastructure can induce economic growth by opening agricultural production in rural regions to urban markets and, in return, disseminating innovative practices in rural areas (Banjo et al., 2012). Poor road accessibility limits the ability of rural producers to sell off their stocks at the most convenient time, which seriously hinders social and economic development in rural areas and leads to higher prices for the final consumers (Olsson, 2009). Regional differences in accessibility explain why some rural regions well connected to national or international markets attract a growing number of entrepreneurs and service providers. This rapid increase in non-agricultural employment in rural areas contributes to a shift from a subsistence-based economy to an economy based on regional markets (Berg et al., 2018). Accessibility gains also benefit small urban centers, which play a crucial role in facilitating agricultural, commercialization, and economic diversification (Owusu, 2008; Tacoli and Agergaard, 2017; Karg et al., 2019).

While a dense transport network remains critical to ensure accessibility from rural to urban regions, improved road accessibility can also benefit regional integration (World Bank, 2020). In Sub-Saharan Africa upgrading the primary road network is widely seen as a major tool to stimulate economic growth and reduce poverty. Buys et al. (2010), for example, estimate that rehabilitating roads between major cities on the continent would expand continental trade by about $250 billion over 15 years. With that in mind, African regional organizations and international financial institutions have expressed renewed interest in transport infrastructure that could address the fragmentation of the transport network, a colonial legacy that prevents African regions to communicate effectively and reinforces their isolation from world markets (World Bank, 2015).

Over the years, several metrics have been developed to measure accessibility in Africa, at the local and regional levels. The literature distinguishes between place-based measures of accessibility, which assess to what extent individuals have access to services and activities (Talen and Anselin, 1988), and people-based measures that analyze to what extent individuals can perform their desired activities within the space-time constraints of their environment

(Neutens et al., 2010). Both measures have been applied to urban settings, where large differences in access to economic, environmental or health resources can be observed across social groups and where individual's activity schedules can be closely monitored.

Thus far, most of the studies conducted in Ghana adopt a place-based approach. They suggest that the rapid urbanization of the country leads to significant accessibility deficits. Acheampong and Asabere (2022) shows for example, that accessibility gains in suburban Kumasi are concentrated within half-a-kilometer distance of a primary road and that the city center remains largely inaccessible due to road congestion. Acheampong et al. (2022) reach similar conclusions in Accra, where the public transport system is largely unable to cope with the growth of suburban areas and the number of private vehicles. In rural areas, studies suggest that inequities in accessibility remain important (Asomani-Boateng et al. 2015). In the Upper West region, Agbenyo et al. (2017) note that poor road conditions are a major barrier in household's accessibility to district hospitals. In the Asanti region, Ashiagbor et al. (2020) show that a third of the population has limited access to specialist services. In the Brong Ahafo and Volta regions, Afukaar et al. (2019) suggest that transport policies are rarely tailored to the specific needs of each region.

These results obtained at the subnational level are largely in line with those of studies carried out throughout West Africa, who note that major disparities in health accessibility can be observed across the region (OECD, 2019a). In countries where formal agreements between countries are poorly enforced, place-based metrics suggest that road accessibility is strongly affected by border delays and checkpoints. A one-hour wait at the border corresponds to a decrease in 14% in accessibility regionally, while roadblocks decrease accessibility by up to 40% along some transport corridors in West Africa (OECD, 2019b). Using a similar approach, Walther et al. (2020) further note that road conditions undermine the accessibility of many border cities. The advanced deterioration of many strategic road axes, they conclude, is a key obstacle to market integration in the region.

3. Material and methods

To assess the impact of transport policies on road accessibility in Ghana, we combine a qualitative analysis of policy documents pertaining to transport infrastructure with a quantitative analysis of road accessibility. The goal of the qualitative analysis is to understand the origins and historical policy choices that have led to the extension of the national road network and the creation or reduction of disparities across regions. It is informed by an analysis of half a century of planning documents, consisting of successive national development plans since the structural adjustment era. This includes the Economic Recovery Program (1983-86), the Transport Rehabilitation Projects (1988-97), the Transport Sector Program Support 1 (1999-03), and 2 (2004-09), and Ghana's Poverty Reduction Strategy (GoG, 2003). We also included policy documents that shaped the road network of the country during the 2010-2019 period, such as the National Transport Policy (GoG, 2008), the Integrated Transport Plan (GoG, 2010), Ghana's Transport Infrastructure Framework (2017a), the Highway Strategic Plan (2017b), the Infrastructure Plan (2019a; 2019b), and the Infrastructure Plan (2020). In each policy document, we examined three fundamental issues: (1) whether transport policies aimed at improving road accessibility nationally; (2) which investments had been made to achieve greater accessibility

across the country; (3) and whether place-based policies were designed to improve road accessibility in specific regions or cities.

The impact of these policies on road accessibility is assessed using a model that measures the area and population that can be reached from 209 cities in Ghana in 2010 and 2019. The infrastructure-based accessibility model measures at which speed people travel across the country using privately owned vehicles. The accessibility model shows drive-time lines connecting all locations that can be reached at the same time in the country (isochrones). To calculate travel times (Figure 1), we divide Ghana into cells of the same size and convert all data sets to raster datasets with a spatial resolution of 10" arc seconds (~300 m). This grid produces a "friction surface" that can be used to simulate movements between every city in Ghana and any other location in the country. Each cell receives a value depending on the properties of roads, land cover, and topography. The slower the average speed, the higher the value. Finally, we combine the location of the cities with the friction surface to produce an estimate of the time needed to travel across each cell.

The model follows a least-cost path algorithm when following a road and integrates the higher speed of flows along this axis. We use a combination of data on roads from the Government of Ghana (GoG) in 2010 and OpenStreetMap (OSM) in 2019. The OSM dataset provides mean travel speeds associated with four types of roads with average speeds ranging from 60 km/h for asphalted highway to 40 km/h for asphalted primary roads, 30 km/h for secondary roads, and 10 km/h for all other roads. To simulate slower speeds off-road and on tracks not covered by OSM, we use land cover data from the European Space Agency (2010). We estimate average speeds in km/h for 32 land cover classes and apply land-cover-related speeds to the topography of the region. For example, an average speed of 4 km/h is estimated where the land is covered with rainfed cropland, while a speed of 1.5 km/h is applied when the land is covered with evergreen or deciduous trees. The estimation of road speed by land cover classes builds on empirical studies conducted in Europe (Van Eupen et al., 2012), where the model was originally developed, and on local surveys conducted in West Africa (Walther et al., 2020) that ascertained the extent to which they matched reality. We interpret steep slopes and rivers as potential obstacles that reduce speed. Using data produced by NASA's Shuttle Radar Topography Mission (SRTM) digital elevation model, we apply a speed multiplication factor of 0.5 to slopes from 15-45 degrees and a factor of 0 to slopes higher than 45 degrees. We also apply a speed multiplication factor of 0.5 to correct for waiting time at ferries and lower speeds at bridges.

The accessibility map includes all cities in Ghana in 2010 and 2019. Cities are identified based on the latest version of the Africapolis dataset produced by the OECD (2019), which defines cities as a continuously built-up area with less than 200 m between buildings and with more than 10,000 inhabitants. These criteria were defined by using a combination of satellite and aerial images and demographic censuses at the continental level. While they may differ from those used in Ghana (the threshold used in this country is 5,000 people), they apply to all countries in Africa, which makes our analysis replicable beyond the Ghanaian case study. The Africapolis definition of cities is also independent from existing administrative boundaries and legislative changes. In Ghana, for example, "localities" were replaced by smaller "communities" between the 2000 and 2010 census. One of the consequences of this change was that some urban localities

identified in the 2000 census no longer met the population threshold requirement and reverted to rural territories in the 2010 census (OECD, 2020).

We use 2010 and 2019 population data from LandScan™ to calculate the population basin of each city outside of urban areas. For each city, seven travel times from cities are calculated, ranging from 30 minutes to 4 hours. Each of these travel times were empirically validated with local surveys conducted in West Africa (OECD, 2017). Short travel times of less than 30 minutes correspond to intra-urban movements in large cities or short trips in smaller centers. Four hours is the threshold at which we assume that day-to-day travel is no longer significant in the region. Indeed, if a trader needs to travel four hours to reach a distant market, and come back, there is not much left in the day for other commercial activities. Additional travel times could be considered, depending on other types of movements, but for our study, the 4-hour threshold is the one that best captures population basins around cities.

Following Geurs and van Wee (2004: 128), our accessibility model is designed to be "an indicator for the impact of transport developments and policy plans on the functioning of the society in general". It has four major limitations. First, unlike other accessibility measures that incorporate land-use components, various services, temporal constraints, or individual characteristics, however, our model treats each city as a node from which one can travel in any direction, rather than as an urban area that would provide a wide range of service and activities. Second, the model does not consider road congestion, potholes, delays at checkpoints, or changes in fuel prices, which are likely to reduce accessibility in some heavily populated or border regions, or across the country. Incorporating such effects, as partially done by Walther et al. (2020), would require extensive surveys that are beyond the scope of this study. Third, the model focuses on road accessibility by car and does not account for other means of transportation. However, motorized traffic on roads is the dominant mode of transportation in Ghana where more than 90% of all traffic uses roads, and more generally in West Africa, where railways are few, dysfunctional, and largely intended for the transport of raw materials (Dethier, 2015). Finally, due to data availability, the model is unable to estimate how road conditions affect average speeds.

4. Historical context

At independence in 1957, the Nkrumah regime inherited a colonial plan that placed the accent upon infrastructure as the key to development. The emphasis shifted in the mid-1960s, as the Seven-Year Plan switched the emphasis to industrial development, financed in part by greater taxes on cocoa. As far as the road network is concerned, this had the net effect of further concentrating resources on the productive south, especially around the Accra-Tema axis. However, investments in road construction and maintenance also fell behind, especially when world prices collapsed, and government revenues placed pressure on the budget. In addition, the ambitious infrastructural investment that was touted by Nkrumah as the *sine qua non* for industrial development, namely the Volta Dam and Lake, had unintended consequences. At the time, little thought was given to the development of inter-modality, integrating lake and road transport. The consequence was that the Lake drove a wedge between the Volta Region and the rest of the country (Map 1). Much of the north and the east of Ghana was poorly integrated with the rest of the country by the end of the 1960s.

Over the decade that followed, the deepening economic crisis led to the marked deterioration of the existing network. To deal with the mounting food deficit, the military regime of I. K. Acheampong launched Operation Feed Yourself (OFY) in 1972, which sought to promote mechanized farming (especially for rice) in the river basins of the north. However, the lack of good roads made it difficult for commercial farmers to get their crops to market. By 1981, the country's national transport network had imploded, with the inevitable result that food rotted on the farms and cocoa was either left unharvested or was smuggled by headload into neighboring states.

With the coming to power of the Provisional National Defence Council (PNDC) in December 1981, the overwhelming priority of the government was to address the transport crisis. Following agreements with the Bretton Woods institutions and the adoption of the Economic Recovery Programme (ERP) in 1983, the foreign exchange squeeze eased, and the government was able to access foreign loans to repair the battered transport network. Predictably, much of the emphasis was placed on repairing road and rail in the mining and cocoa-growing areas. However, as successive Structural Adjustment Programs replaced the ERP, it became possible to channel greater resources into upgrading other rural roads and to rehabilitate the country's main arterial roads, especially those linking the regional capitals.

Map 1. Cities, urban areas and regions of Ghana

Source: authors. Note: The following regions were created in 2019: North East, Savannah, Oti, Western North, Bono, and Bono East.

The Transport Rehabilitation Projects (1988-1997) were designed to increase export, farm production, and labor mobility through rehabilitation and maintenance of transportation infrastructure. The Road Sector Development Programs (RSDP) that began at the start of the millennium involved the rehabilitation of trunk, feeder, and urban roads throughout Ghana. While emphasis was placed upon extensions and improvements to rural roads during the adjustment phase, the Ghana Poverty Reduction Strategy (GPRS) made feeder roads the medium-term priority, but with at least one urban-rural road earmarked for rehabilitation or development in each region, as

well as the development of three major highways to meet the needs of the agricultural and industrial sectors.

At this time, the pace of construction accelerated noticeably, with the overall length of roads increasing from 38,000 km in 2000 to 60,000 in 2005. Two Transport Sector Program Support projects (TSPS-1 and TSPS-2) were implemented from 1999-2003 and from 2004-2009 with the aim of better connecting rural areas to markets. Both projects contributed to dramatic growth in household income and expenditures, crop production, motor vehicle use, access to markets, schools, and health facilities, and transportation changes during the initial phase. However, these positive indicators shifted after a surge in fuel price in 2004 that made motorized transportation much more expensive (Asomani-Boateng et al., 2015).

5. Results

Using our accessibility model, this section examines (1) whether transport policies have achieved their goal of improving road accessibility at the national level and (2) whether road accessibility disparities have increased or decreased from 2010-2019.

5.1. Has road accessibility increased nationally?

Improving accessibility at the national level has long been one of the key objectives of Ghana's transport policies. It is not until the late 2000s, however, that a truly comprehensive National Transport Policy (NTP) based on the Ghana Poverty Reduction Strategy was implemented (GoG, 2008). This plan was, in turn, followed by the adoption of an Integrated Transport Plan from 2011-2015 in which transport was presented once again as the key to economic development as well as poverty reduction. Following the ending of GPRS II, transport was accorded a central place within the Ghana Shared Growth and Development Agenda (GSGDA), which was renamed the Co-ordinated Programme of Economic and Social Development Policies (CPESD) with effect from 2017. The imperative of shaping a fundamentally new approach to transport was based on the perception that inertia and unclear institutional mandates had led to less-than-optimal outcomes. The emphasis was placed on the need to hone a clear strategy, to achieve better accessibility at the national level. The National Transport Policy, for example, aims at promoting "the systematic development of all modes of transport for efficient and effective modal choice in all regions of Ghana" (GoG, 2020).

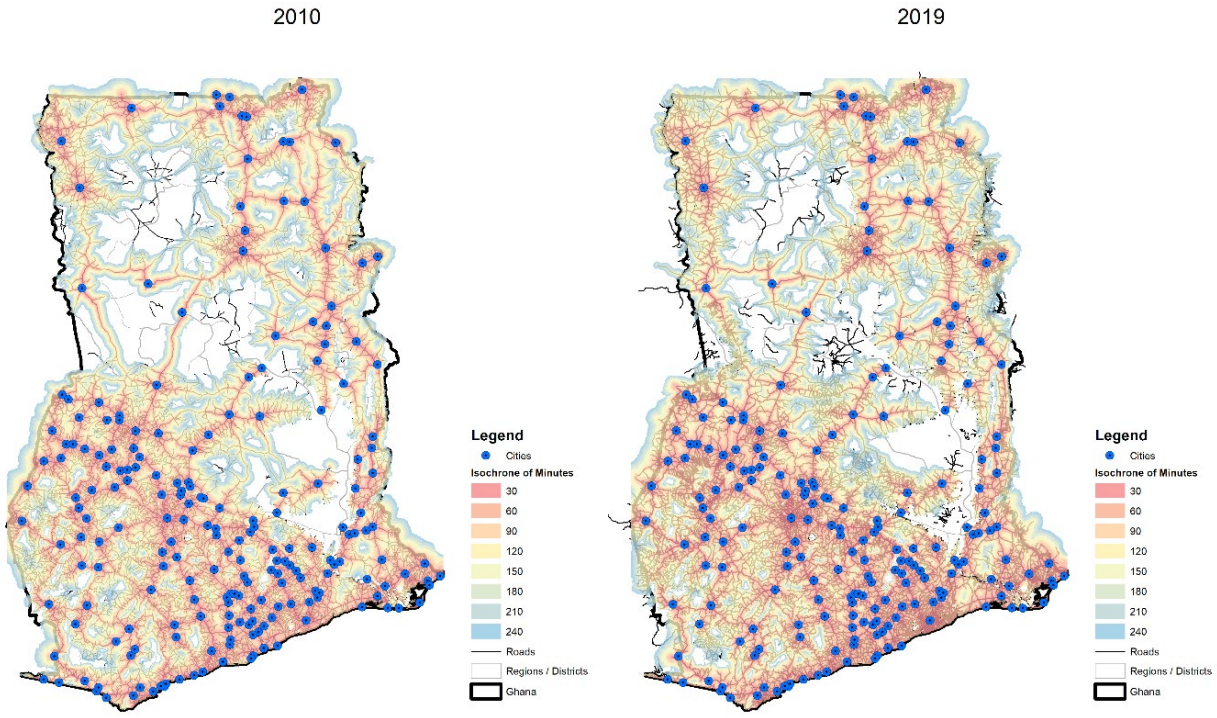
The official documents were explicit about the factors that were driving the need for a new transport policy that provides better access to all regions of Ghana. The first was major demographic changes, as Ghana underwent the transition to being a predominantly urban country. This underlined the importance of promoting better transport links between rural areas and urban centers, as well as the need to pay greater attention to urban roads and mass transit in the cities. The Ghana Infrastructure Plan (GoG, 2019b: 147) notes, for example, that: "One of the main challenges to the growth of agriculture in Ghana is access to markets… [A]bout 50%-70% of food prices in urban centers is due to transport-related costs. Therefore, better accessibility can help to reduce consumer prices of agricultural products". The second factor was the historic failure to actively embrace multi-modal transport options. Hence, the Volta Lake had remained both a major obstacle to trade exchanges between the east and west of the country and an

unexploited asset, while neglect of the rail network had forced more heavy trucks onto the roads, with consequences for congestion and surface degradation alike. Thirdly, the new approach was informed by a requirement to properly factor in compliance with international standards and commitments.

To implement these policies, Ghana's investments prioritized three transport corridors, running north-south. The first corridor, which ran from Accra through Kumasi, Tamale, and Bolgatanga to Paga on the Burkina Faso border, already existed. This was partially true of the second that stretched from Takoradi, through Sunyani and Wa to Hamile on the same border. The third corridor passed from Tema through Hohoe and Yendi to Tamale, where it connected with the main spinal route to Burkina. The government also added two east-west corridors: the first was the same as the Abidjan-Lagos Corridor, while the second connected the far north-east of the Upper East Region with the western border of the Upper Region.

Our model suggests that these initiatives have clearly improved road accessibility nationally, as can be seen on Map 2, which compares travel times in 2010 and 2019. While only 74% of the territory could be reached in less than four hours in 2010, this proportion has increased to 80% nine years later. The length of the overall road network has significantly increased over the period considered, from 64,519 km in 2010 to 77,908 km in 2019 (+21%).

Map 2. Road accessibility in Ghana by travel times, 2010 and 2019

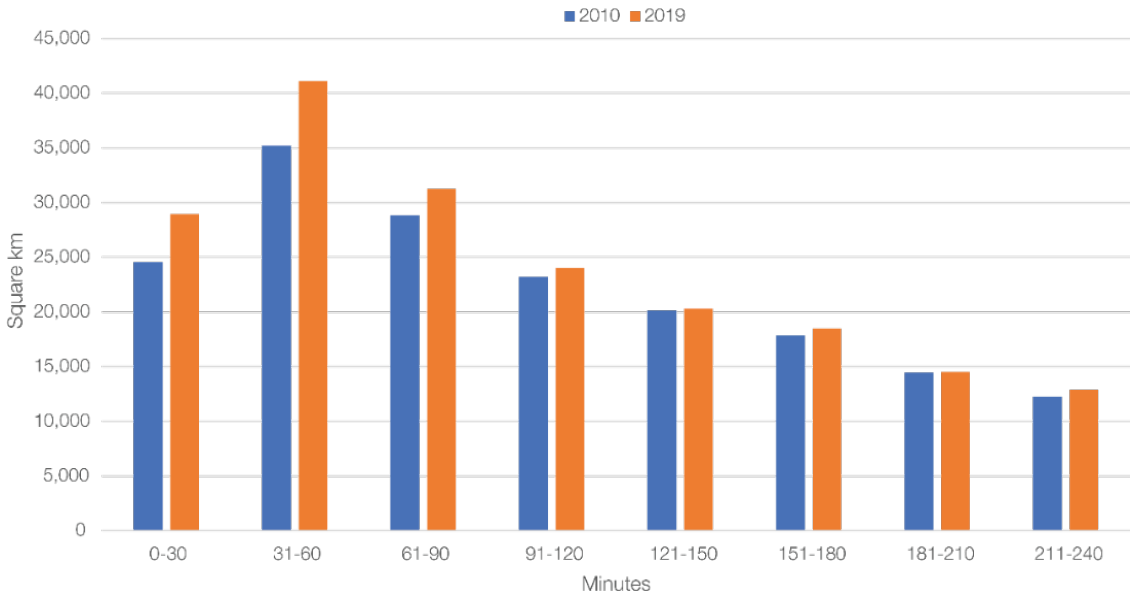


Source: authors.

Significant gains in accessibility are observed within 90 minutes of a city. These regions represented more than 100,000 km^2 in 2019, or 42% of the country, against 37% in 2010.

However, road accessibility has stagnated in the most remote areas of the country located more than one hour and a half from one of the 209 surveyed cities. Figure 1 shows for example that virtually no accessibility gains were observed between 2010 and 2019 in regions located more than 3 hours from a city (181-240 minutes).

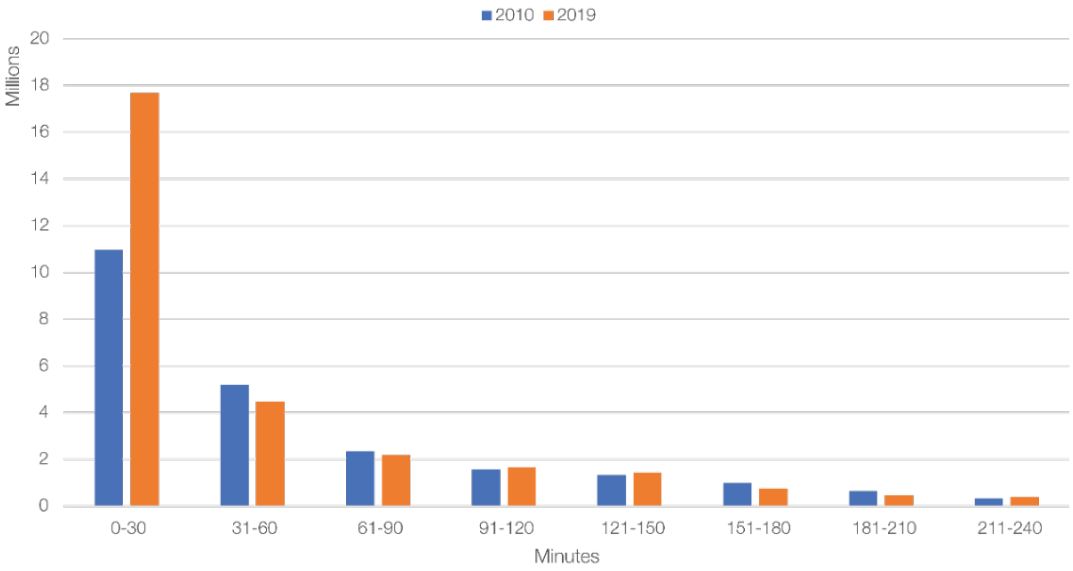
Figure 1. Accessible area by travel times in Ghana, 2010-2019



Source: authors.

The analysis of the population that can be reached in each travel time leads to similar conclusions (Figure 2). The population that has benefited the most from accessibility gains is located within half an hour of a city, while only a marginal increase in population is observed further away from urban centers. These results suggest that accessibility gains have mainly benefited urban and peri-urban areas, and regions of the country where cities are close to each other.

Figure 2. Accessible population by travel time in Ghana, 2010-2019



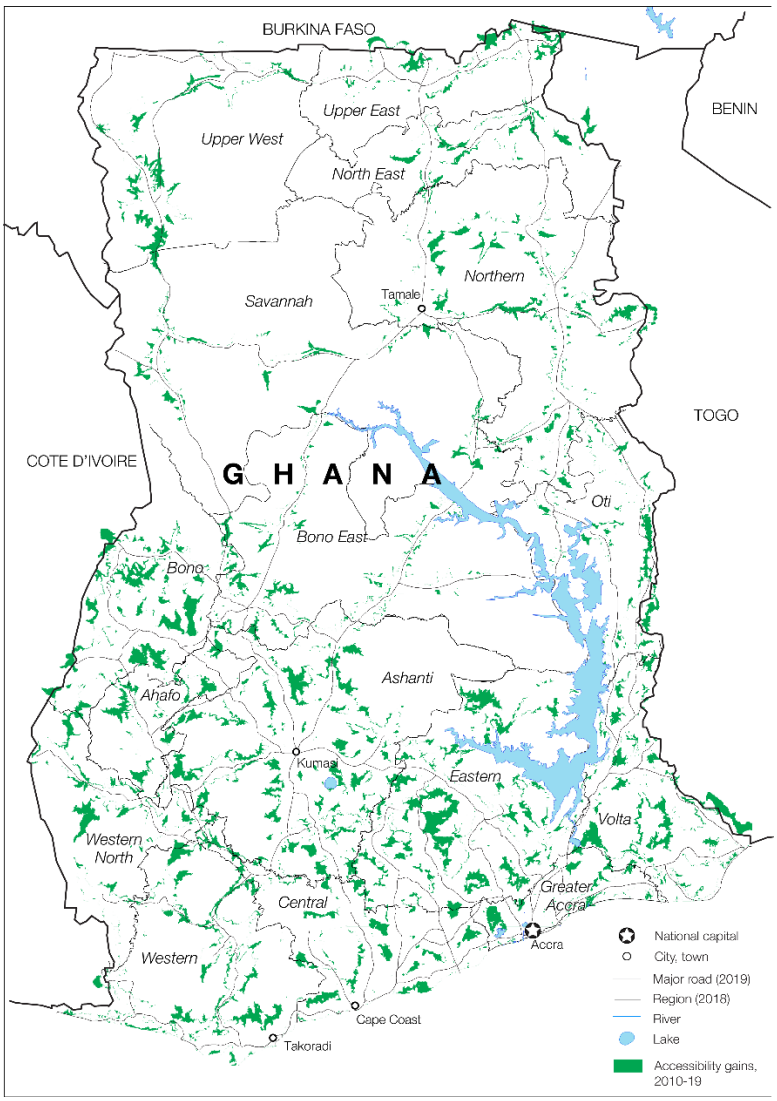
Source: authors.

5.2. Have regional disparities increased or decreased?

The implementation of transport policies that encouraged greater accessibility at the national level took place in a political context marked by a growing decentralization of state administration and revenue. The outcome of this long and convoluted process, which started in the late 1980s, was the carving out of six new regions in 2019: the Northern region was split into Northern, North East and Savannah; the Volta region was cut between Volta and Oti; the Western region was divided between Western and Western North; and Brong-Ahafo was split into Bono, Ahafo and Bono East. The creation of new regions came with a clear expectation that they would benefit populations who had historically had to endure the worst roads. As indicated in the Report of the Commission of Inquiry into the Creation of New Regions (GoG, 2018: xxii), "analysis of road inventories (…) in each of the six regions revealed that the network of roads does not adequately serve most rural people". It was also understood that the capitals of the new would be upgraded and provided with better links both to other regional capitals and to the district centers (Penu, 2022).

Our results suggest that the transport policies implemented during the decentralization period did not manage to reduce regional disparities, particularly between the North and the South of the country, and between Accra and other cities. On the contrary, the regions where accessibility has increased the most are all located in the southern part of Ghana, both in existing regions such as Ashanti and "new" regions carved out of existing regions, such as Bono or Western North. Map 3 shows, for example, that the regions accessible in less than one hour in 2019 but not in 2010 are mainly located in the forested areas of the Southwest, and along major transport corridors, for example between Accra and Kumasi. By contrast, all northern regions, and Central Region, have experienced slower growth in accessibility than the country average. In other words, accessibility disparities do not separate existing regions from "new" regions, but regions that were historically well connected to the national road network to peripheral regions.

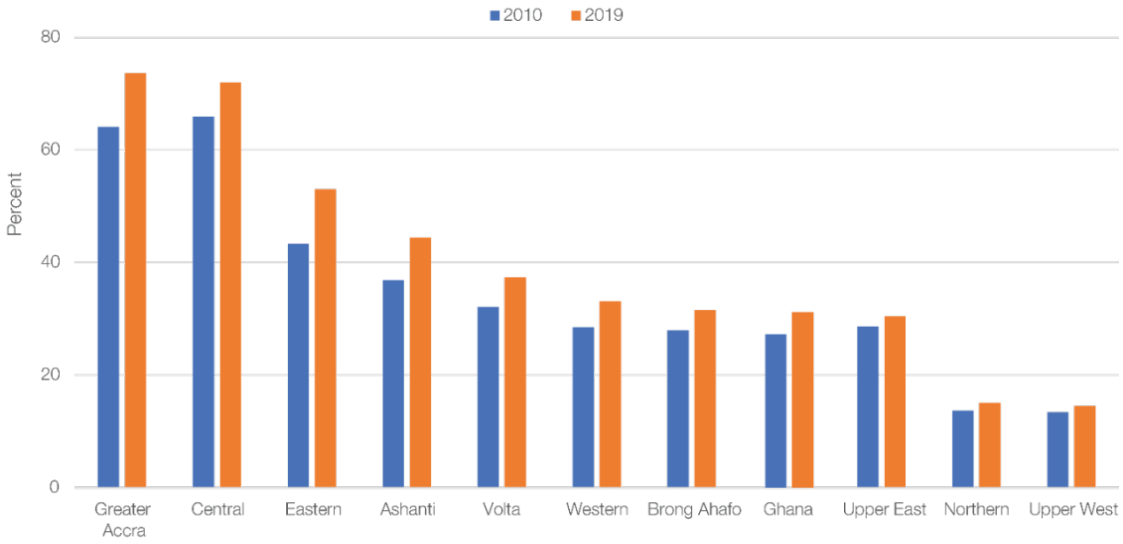
Map 3. Accessibility and accessibility gains in Ghana, 2010-2019



Source: authors. Note: green areas correspond to the regions accessible in less than 4 hours in 2019 and not in 2010. The following regions were created in 2019: North East, Savannah, Oti, Western North, Bono, and Bono East.

Accessibility gains have been particularly important in the Greater Accra, Eastern and Ashanti regions from 2010-19, where an increasing share of the region can be reached in less than four hours from any city of the country as defined by Africapolis (Figure 3). The north of the country also counts the regions that have the poorest accessibility in general (Table 1). In the Upper East, less than a third of the total area of the region is accessible in less than one hour from a major city. This proportion is even lower in Northern and Upper West regions where less than 15% of the total area is accessible. The largest geographic coverage can be found in Greater Accra and Central Region, where 74% and 72% of the region is accessible in less than one hour from a city.

Figure 3. Accessibility as a percentage of the region's area, 2010-2019



Source: authors. Note: the figure shows the percentage of the region's area accessible in less than 4 hours by road in 2010 and 2019.

Table 1. Accessible area in less than 4 hours by region, 2010-2019

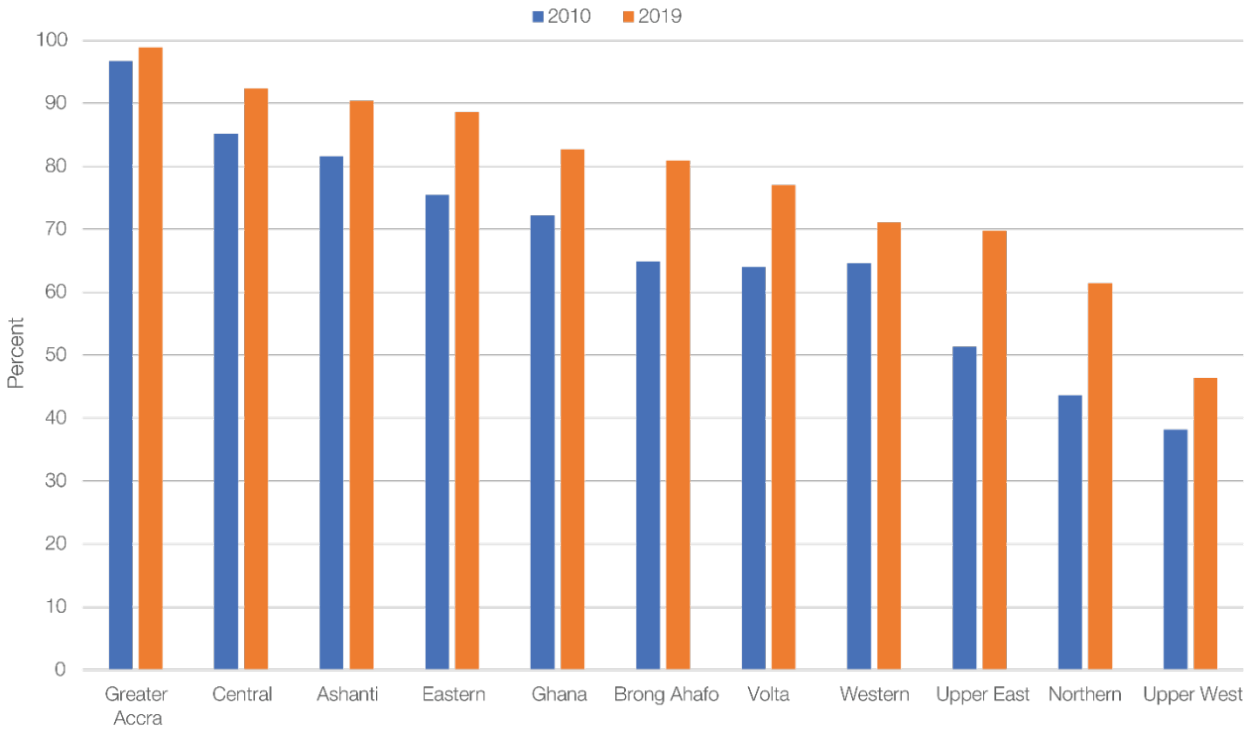
Region	**Accessible area in 2010, km^2**	**Accessible area in 2019, km^2**	**Total area of the region, km^2**	**Growth 2010-2019, %**
Ashanti	9,306	11,206	25,258	20.4
Brong Ahafo	11,245	12,664	40,210	12.6
Central	6,420	7,007	9,743	9.1
Eastern	8,119	9,930	18,734	22.3
Greater Accra	2,386	2,743	3,727	15.0
Northern	9,741	10,756	71,351	10.4
Upper East	2,553	2,714	8,913	6.3
Upper West	2,623	2,839	19,539	8.2
Volta	6,699	7,777	20,857	16.1
Western	7,085	8,229	24,839	16.1
Ghana	**66,177**	**75,865**	**243,171**	**14.6**

Source: authors.

The model also suggests that the most populated and urbanized regions have experienced the largest accessibility gains in the last decade (Figure 4). Around 90% of the population of Central, Ashanti, and Eastern regions and nearly the totality of the population of Greater Accra can be easily reached by road in 2019. Urban sprawl in Accra is now reflected in accelerated construction in the southern parts of the Eastern Region, which have become a commuter belt for the capital. By contrast, less than half of the population of the Upper West region and 60% of the population of the Northern region are accessible in less than four hours by road.

This evolution is due to the rapid growth of the mining and agricultural front in this region. Ghana has experienced significant deforestation over the last several decades, particularly in the southwestern part of the country, which is subject to unprecedented anthropogenic pressures from logging, rapid urbanization, and agricultural expansion. The rapid deforestation of the Ashanti, Ahafo, and Western regions is facilitated by the development of a dense network of small roads that connect the major roads to the plantations, mining sites, and new villages created in previously forested areas (Asibey et al., 2020).

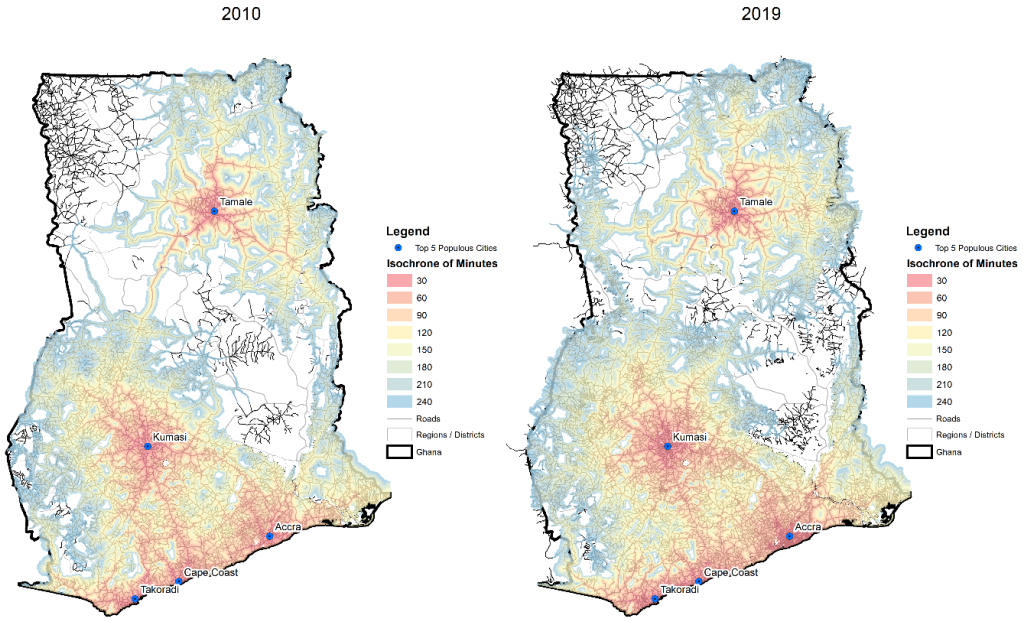
Figure 4. Accessibility as a percentage of the region's population, 2010-2019



Source: authors. Note: the figure shows the percentage of the region's population accessible in less than 4 hours by road in 2010 and 2019.

The regional disparities in accessibility observed from 2010-19 reflect differences in population densities and urbanization rates. While more than half of the population of the country lives in cities, urban growth is driven by southern cities, leaving the north of the country less populated and less urbanized. These regional disparities are clearly visible on Map 4, which shows travel times for the five largest cities of the country in 2010 and 2019. In the south of the country, relatively short distances between cities and a dense network of major and secondary roads provide ideal conditions for accessibility. Kumasi is the city that has the most extensive accessibility area (> 98,000 km^2 in 2019). Unlike in Accra or Cape Coast, the road network centered on Kumasi is not limited by the presence of the coast and can extend in all directions. As shown on Figure 5, the expansion of the Kumasi road network is also the fastest of the major cities in the country between 2010 and 2019 (+15%), followed by Accra (+14%) and Cape Coast (+13%).

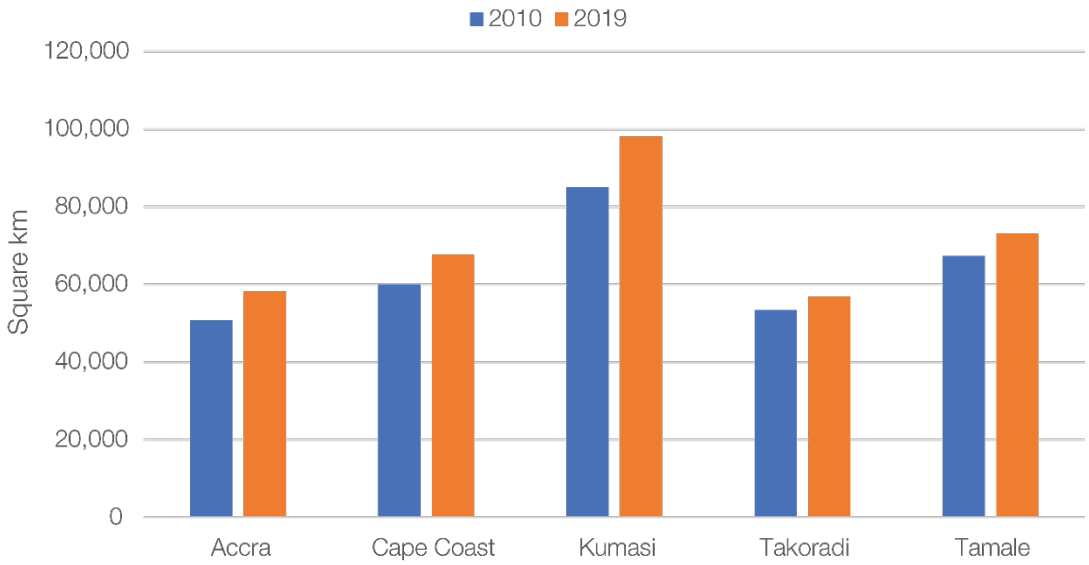
Map 4. Road accessibility of Accra, Cape Coast, Kumasi, Takoradi, and Tamale, 2010-2019



Source: authors.

One of the consequences of such evolution has been to reinforce the centrality of the largest urban centers of the country. Recent transport policies have largely focused on the capital city, leaving issues of congestion, urban spread, pollution, and accessibility largely unaddressed in other smaller centers (Yeboah and Asibey, 2019). In a country dominated by two main urban centers (Accra and Kumasi), secondary cities are seen through the prism of suburbanization and congestion rather than as locus of innovation that could favorably transform agricultural activities and services in their market areas. The Ghana Infrastructure Plan, for example, notes that the country should "reverse the current urban sprawl, adopt dense and compact settlement systems, and leave a large part of its rural area for agriculture" (GoG 2019b: 154).

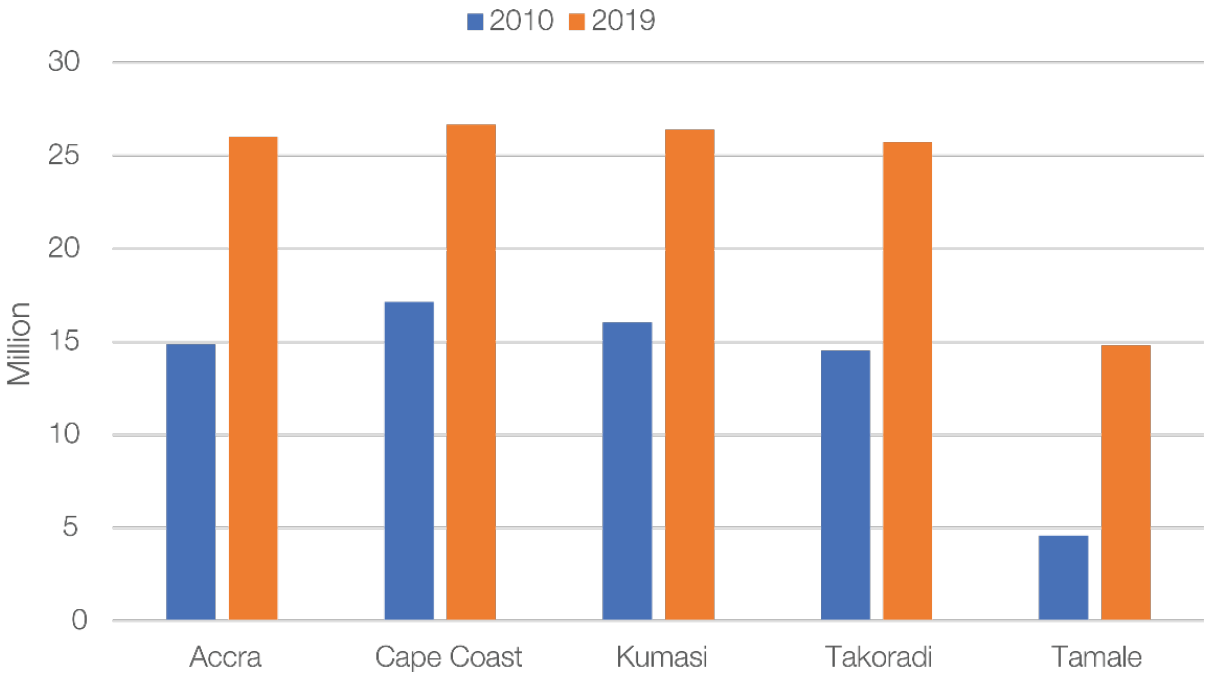
Figure 5. Area accessible in less than 4 hours from major cities, 2010-2019



Source: authors. Note: the figure shows the area accessible from a selection of cities by road in 2010 and 2019.

Regional disparities between the south and the north of the country are particularly visible when the population basin of major cities is compared (Figure 6). All major cities have experienced a strong increase in their population basin due to the expansion of the road network and to the rapid annual population growth of the country (+2.1% in 2020). Around 25 million people can be reached in less than four hours by road from Accra, Cape Coast, Kumasi, and Takoradi in 2019, against around 15 million in 2010. In comparison, the population basin of Tamale, in the north, counts less than 15 million people in 2019, despite a rapid increase in the last decade (+222%). One of the demographic peculiarities of the North is the historically low population density of the southwestern part of the region (Gonja) which shows up as the white bald patch on Map 3, south of Tamale. Even if the government manages to improve and develop the national network, the distance that separates the Sahelian and Guinean regions of Ghana and the sparse population densities between the two regions will remain a formidable obstacle to transport policies.

Figure 6. Population accessible in less than 4 hours from major cities, 2010-2019



Source: authors. Note: the figure shows the population accessible from a selection of cities by road in 2010 and 2019.

6. Conclusion

The goal of this paper was to examine the impact of transport policies on road accessibility in Ghana in the last decade. Using an accessibility model that calculates which share of the territory and of the population is accessible by road from any city of the country, the paper suggests that, while accessibility has globally increased, transport policies have been unsuccessful at reducing regional disparities. Southern regions and cities have benefited more from the improvement and development of the road infrastructure than the rest of the country. Accessibility gains are particularly important in the southwestern part of Ghana, where new feeder roads encourage mining, agriculture, and urbanization in previously forested areas. By comparison, accessibility remains poor in the north of the country.

These results suggest that, despite changes of government in 2000, 2008 and 2016, there has been a large degree of continuity with respect to transport. Regional disparities are reinforced by the general distribution of the population. In Ghana road accessibility reflects, to a large extent, the unequal growth of cities and the development of the urban network. The overall consequence is that the transport system in Ghana continues to reflect incremental effects and governmental responses to short-term contingencies as much as it is driven by planning visions.

These results have implications for Ghana's medium-term vision, which is premised on the transformative effects of transport infrastructure. The Transport Infrastructure Framework (2017) includes the expansion of road networks from 72,000 km to 253,000 km by 2047, the investment

of $272 billion in road development, the improvement of road safety and quality, and the creation of extensive bus routes and suburban railways. This vision is part of the Ghana Infrastructure Plan (GoG, 2019b), which takes a comprehensive look at the infrastructure-based issues of the country, and aspires to integrate national space more effectively, in a manner that goes beyond the rhetoric of balanced national development that had long been spoken of, but never actively promoted.

Implementing this new plan will require reconciling the desire to properly design an integrated national policy, whilst devolving more responsibilities to metropolitan and district assemblies under decentralization. On the one hand, the recognition of district capitals has come to be associated with the perceived need to peg their infrastructure to something approximating to a minimum standard. Because electoral boundaries could not crosscut the districts, the creation of new constituencies to reflect shifting demographic realities has since led to a proliferation of new districts and further pressure for upgrading. Within the four-year cycle of national elections, the demand for better roads has proved one of the most enduring factors in shaping voter preferences (Harding, 2015).

On the other hand, local government bodies will be expected to bear more of the cost of maintaining urban and feeder roads, even though local government bodies are already financially strapped. The new National Transport Policy has placed even greater emphasis on Public-Private Partnerships, especially with respect to expensive projects involving ports and railways (GoG, 2020). When it came to roads, the financing of corridors through external loans, for example from the African Development Bank, had implications for the public debt. Whereas private capital was expected to finance rail extensions, roads were a direct charge to the public purse. An important underlying principle was that as much as possible of the cost of maintaining highways should derive from road tolls. The Accra-Tema motorway was for decades the only toll road, but tollbooths became ubiquitous along the main arteries. Ironically, this compounded the problem of congestion in the roads feeding into urban centers. Partly for this reason, and because of the perceived need to address the environmental consequences of idling traffic, the NPP government announced its intention to abolish road tolls in 2021. This provides an instance where the economic and the environmental principles were at odds with one another.

Hence it is difficult to imagine that road quality will be significantly improved in the medium-term without an injection of funding from the center. In addition, decentralization potentially made it more difficult to reconcile land management and transport planning needs in a context where local government exercises devolved powers. This was a major concern for urban roads, but also along the highways where unregulated housing construction threatened plans for road widening and the addition of lanes. The current GHA Road Plan is highly ambitious in its projection of four new east-west corridors running from the Ivoirian to the Togo border, and two of these are envisaged for the north. However, the fact that a substantial number of new priority roads have been earmarked based on traffic projections, and that all but a single small segment is in the south, is likely to feed a vicious circle of regional inequality in the years to come.

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