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Africa: Her Space-Time Convergence Status

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The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

Today, the research interest on the state of mobility and accessibility of a place is growing everywhere. Previous studies on space-time convergence have shown that, the world has become 'flat' due to fastness in accessibility of places by goods, information and the people. Whereas this is true, the prevailing state of space-time convergence in Africa is still an outstanding issue of concern. This paper aims to fill this gap through story telling of the information borrowed randomly from existing literature on the subject matter. The results obtained show that, Africa is yet to fully get integrated proper into the global networked society because of her huge transport and communication infrastructure gap. The paper concludes with a recommendation that, African leaders should endeavour to fix the infrastructure gap and must at the same time, purpose to allow a faster cross border movement of goods and people to help speed up space-time convergence to match the global mobility pace.

Keywords: Mobility; accessibility; distance; time and speed.

1. INTRODUCTION

The purpose of this article is to describe and discuss the state of Space-Time Convergence (S-T-C) in Africa in terms of accessibility of places and the attendant cost of mobility of people, goods and services. This has been

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achieved through story telling from the information borrowed randomly from existing literature on this subject matter of S-T-C. The discourse on S-T-C has always covered three genres, which are; the friction of distance between two points in a place, that is the cost component of travel between two points in a place. Second, is the accessibility or generally, the ease with which one can reach the two locations within the place under coupling constraints condition (a definition of when and for how long a person has to be corporeally present at a given physical location). And thirdly, is the issue of connectedness, which is to do with the reliability of traveling the distance between the two locations of a place at any time of choice. Each of the genres is addressed in this paper. However, the primary focus of this research paper is to report on the overall status of the S-T-C in Africa. Previous studies have shown that S-T-C is concerned with the; "when", "where" and "why" of events. The ''where'' of an event is a culturally regulated phenomenon, and is often represented on a map. A map is ideally not a reality per se, but rather a representation of a locality, its bound objects and entities [1]. In that context, the areal extent of the continent of Africa is the meaningful place of interest in this paper.

A meaningful place is one with a space of value to an individual or a group of people. For example, a hotel room quickly becomes a valuable space to a patron soon after booking. Within the place, a certain event can occur within the space of value defined by a set of geographic coordinates, X, Y, Z at a time defined by date, hour and duration. The duration is metaphorical in the sense that, it can bring in some sort of visceral feelings. For example, the distance between points, A and B within the space can be described by the duration of time of traveling which when interpreted from the mode of transport used, may bring a sense of different distances between the two points. For example, one may say, using a car, the distance between the two points is short unlike when the distance is covered by walking. So, the distance between A and B is the amount of time of travel or the cost of travel. It has been argued by scholars including [2] that, S-T-C is a reflection of how human societies have reduced the factor of distance and facilitated the interaction between points within a space. This is in line with the way Eugene Staley viewed the world economy as being in transition. Later, this way of thinking inspired John McHale's prediction on the revolutionary nature of science with regards to the shrinking earth conception due to advances in transportation technology which has hereto increased the speed of travel and the world today has become a global village.

The issue of S-T-C is linked to the scientific advances that have shortened our travel time in what Antony Dickens attributes to immense changes occasioning global shifts in the contour of the world economic map. Innovations in transport technology have gradually reduced travel times, and this process has been discussed in the context of international- or national-level transport changes. This paper aims to report on the status of the changing relationship between flow time over known distances as an important indicator of our mobility efficiency. It is organized thus, Section one, the introduction and section two is about the background. Section three, presents related work, four highlights the measurement of space time convergence, five presents results while six is discussion. Lastly, section seven presents conclusion.

2. BACKGROUND

Africa has for long been viewed from Hegelian dystopian lens, as a place without civilization [3]. Scores of scholars, Omotade Adegbindin included on their part, have repudiated strongly the Hegel's cultural framework of Africa [4]. They contend that even though many previous studies on Africa's mobility have sometimes brought out the element of time delays and frustrations, this does not mean, Africa is not developing. It is however a fact that, Africa is a host to 34 out of 50 least developed nations of the world [5] which has tied her back due to poverty [6]. Because of poverty, there is a huge gap in transport infrastructure and this means traveling in some parts of Africa is full of stress as was reported in the Ghana study by [7,8]. As long as Sub Saharan Africa is still the poorest region of the world [9], the economic hitmen from the west will still enrich themselves in the globalization shifts via capital flight [10].

Accelerating the rate of S-T-C in Africa must be done through increasing efficiency in mobility. In its most basic form, mobility, is defined as the ability to move between different activity sites. Scholars have always used the Lefebvrian spatio-temporal analysis approach to highlight the impact of mobility in the changing rhythm of life in society [11]. It goes that, nowadays, humans travel on many spatial scales, ranging

from a few to thousands of kilometers over short periods of time. A person in the 21st century can reach virtually any point on the globe in a matter of days [12]. It comes as no surprise that today – in times of almost instant global communication via the internet and rapid global transport (triggered by containerization and the accessibility of air travel) – many observers share a similar impression of geographic space being annihilated. Scholars talk about the 'convergence of space and time,' an ongoing 'space-time compression' (the disempowerment of space) – all of which have also been witnessed in the second half of the nineteenth century, especially in those world regions which were then penetrated by new transport and communication technologies [13]. The intensity of modern human travel is convincingly illustrated in Fig. 1 which depicts nearly the entire international air traffic network [14].

Mobility or motility as discussed by Kaufmann and colleagues, has transformed the world to a global village due to driving on roads, flying through airports and the power of the Information and Communication Technology [15]. Appiah, while discussing the place of Africa cultural philosophy in his book, 'In My Father's House: Africa in the Philosophy of Culture' eloquently affirmed [16] the work of V. Y. Mudimbe about Africans' liberty in accepting the Western culture [17]. This is why it is often said that the premise of Africa-cantered scholarship is not merely that it emphasizes the importance of studying Africana phenomena, but also that it attempts to engage that study beginning from Africana philosophical perspectives. This is a critical challenge for the Africa cantered scholars because they often have to do "double duty," both developing the theoretical and methodological context for analysis and conducting the analysis. They are simultaneously engaged in scientific investigation of "what is" and also constructing a redefinition of "what is" and "what's possible" and "from what perspective should variables be examined." Time and space discussion in the African context is no exception. The aim of this paper therefore is to assess the state of the Africa's space-time convergence.

The legendary geographer, Donald Janelle was the first scholar who analysed the contribution of transportation and communication systems on time-space convergence in 1966. In his work, time–space convergence (TSC) refers to the decline in travel time between geographical locations as a result of transportation, communication, and related technological and social innovations [18]. A survey of Africa's transportation infrastructure literature reveals a sense of a dominant genre, which is that, Africa has a huge transport infrastructure gap, which other scholars call, 'proximity gap' [19]. We are living in an era of increasing African mobility [20]. Spurred on by steady economic growth in many parts of Africa and global revolutions in transport and communication, migrants of African origin have increasingly spread across both continental Africa and the world at large. That is the reason, Vigneswaran's work asserts that, states in Africa must promote both long-distance and everyday movements [21,22].

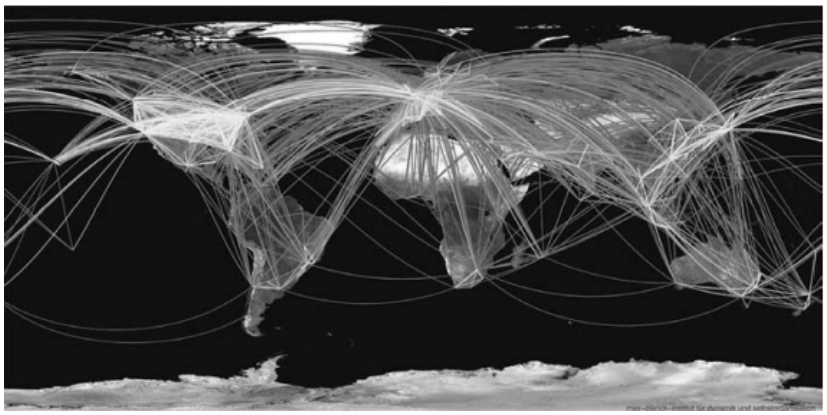

Fig. 1. Worldwide air traffic network. Links represent routes between the 500 most frequented airports. Brightness indicates the intensity of traffic between nodes. (Source. Brockmann, D. (n.d.). Money Circulation Science– Fractional Dynamics in Human Mobility.)

Mobility studies in Africa has attracted varied interests. For example, Alberto Alesina of the Department of Economics at Harvard University and his colleagues on their part, focused their attention on Intergenerational Mobility within Africa, which found that, the average upward intergenerational mobility is 0.58, regional intergenerational mobility ranges from 0.18 to 0.82, with rates below 0.4 across the Northern regions and above 0.7 in the South. The mean downward mobility is 0.20, but also greatly varies from 0.08 to 0.50 [23]. All these against the backdrop of Africa rising slogan, a global buzz [24]. This paper however is looking at the time-geography studies of the changes in African society. This paper takes the cue from Torsten Hägerstrand and his research group. According to Hägerstrand, societal change, is characterized by the space in which one grows up in. He further adds that, the changes in society are not easy to capture for people living in the ongoing processes, even though elements of the changes might be obvious if looked upon one by one. The time-geographic approach is Hägerstrand's effort to provide intellectual and conceptual tools to capture, describe and analyse the evasive phenomena of ongoing change processes in society and nature [25].

The examination of the extent to which Africa, in particular, is adversely positioned in relation to the flows and circulations of time-space compression in our globalizing world is an important adventure because it has been found that, Africa is marginalized in the network society [26]. This is evident from the exorbitant costs wrought upon Africans (by way of Internet charges, air travel costs, phone charges, etc.) as a result of the acute dearth of time-space compression technologies on the continent [27]. The discussion is grounded in the following rhetorical question: if, indeed, globalization is not just only about homogenization, but also discernible heterogenization (in the form of uneven geographic development, power imbalances, and social differentiations), why, then, are suppositions of a unifying, global village so fashionable in the available literature?

Put differently and as discussed by [28], why are categorical assertions of a shrinking, homogenizing world of unbridled mobility, time-space compression, and space of flows so fashionable in the prevailing discourse on globalization? In Africa, scholars say, mobility is still a scarce resource and the overwhelming majority of her population as elsewhere in the global south is more or less permanently immobilized [29]. Africa is often seen as a continent of mass migration [30] and displacement caused by poverty, violent conflict and environmental stress [31]. Yet such perceptions are based on stereotypes rather than theoretically informed empirical research [32]. Building on Doreen Massey's power-geometrics, [33] explained the transformative nature of information and transportation technologies in East Africa, and asked the question, is mobility felt by all in Africa? The argument here is about the marginalization of Africa in its attendant time-space compression [34]. The paper is not seeking to identify the causal factors behind Africa's weak attachment to the network society, per se, but to show the extent to which the continent is "falling out" of the shrinking world, as a way of drawing the attention of the powers that be in Africa to the urgent need to redress the situation. In particular, the paper paints the picture of Africa's state of mobility, for it is established fact that, the poor state of her infrastructure is a contributor to high transport costs [35].

3. SIMILAR WORKS ON SPACE-TIME CONVERGENCE

Popularized by the geographer David Harvey in his well-acclaimed 'the Conditions of postmodernity', "time-space convergence" refers to the processes that have reduced spatial barriers and accelerated our experience of time [36]. Put differently, it is the shortening of time and the shrinking of space, or what Karl Marx once called "the annihilation of space by time" [37]. According to Harvey, time-space convergence (compression) has so revolutionized the "objective qualities of space and time that we are forced to alter, sometimes in quite radical ways, how we represent the world to ourselves." Harvey writes that he uses the term compression "because a strong case can be made that the history of capitalism has been characterized by speed-up in the pace of life, while so overcoming spatial barriers that the world sometimes seems to collapse inwards upon us". For the most part, the convergence alluded to here is attributable to advances in transportation and telecommunication technologies such as cell phones, blackberries, faxes, the internet, and highspeed automobiles, trains, and airplanes.

Naumi, a Yale University law scholar once said, "place and mobility matter and their interactions

are the key drivers of productivity", [38]. This conclusion has been confirmed by numerous books and articles published in recent years, which have argued explicitly as well as implicitly, that the human world today is so mobile, so interconnected, and so integrative that it is, in one prominent and much-repeated assessment, "flat". The "forces of flattening" oscillate around how humans have become mobile hence so interconnected and so integrated, and that the power of space and time continue to hold billions of people in an unrelenting convergence grip. Space-time convergence (also labelled as space/time compression) refers to the decline in travel time between similar locations. This implies that two locations can be reached in a lesser amount of time, which is usually the outcome of innovations in transport and telecommunications [39]. Space-time convergence investigates the changing relationship between space and time, including the impacts of transportation improvements on such a relationship. It is closely related to the concept of speed, which indicates how much space can be traded for a specific amount of time. Borrowing from the explanation outlined in the book, 'geography of transport systems', in chapter one by [40], it is recorded that, to measure space-time convergence (STC), travel time information is required for at least two locations and two time periods. Variation in travel time (ΔTT) is divided by the time period (ΔT) over which the process took place; the slope of the curve, see Fig. 2.

The above figure provides an example of space-time convergence between two locations, A and B. In 1950, it took 6.2 hours to travel between A and B. By 2000, this travel time was reduced to 2.6 hours. Consequently, STC was for that period of -0.072 hours per year or -4.32 minutes per year. The value is negative because the time value is being reduced (fewer hours travelled). If the value was positive, a space-time divergence would be observed.

In a groundbreaking research paper on mobile phones, mobility practices and transport organizations in the Sub-Saharan Africa, Porter said," information and communication technologies (ICTs)—in particular, mobile phones—are rapidly changing the face of Africa". A growing literature, he adds, shows how these technologies are reshaping the way business is done, the way social networks are built and maintained, even the conduct of romantic courtship. And in conclusion, he submitted that it is likely that, mobile phone usage will continue to be complexly interwoven with physical mobility and, increasingly, with transport technologies and that, over time, those patterns of interweaving will regularly reshape and reform [41]. This was a contradiction to the earlier finding by Joseph Mensah, who in 2006, had painted a sorry picture about Africa's mobility. Mensah stated that space-time convergence in the African context was in a reverse gear with the world trend. He said," our upbeat assumptions about how the world is shrinking into a global village in which people are becoming alike (socio-culturally and economically) seem to "rest on a large element of imagination or wishful thinking without empirical substance". There is enough evidence to suggest that the "global village" is divided between streets of "haves" and "havenots". Still, unlike the socioeconomic polarization of the past, what one finds under contemporary globalization is a complex reconfiguration of the world order into a formation that does not readily submit to simple, bipolar categorizations, such as core/periphery or First World/Third World, without any caveat. At a very broad theoretical level, one can still deploy such binaries, but they are certainly of limited utility in any nuanced analysis of the contemporary global architecture" [42].

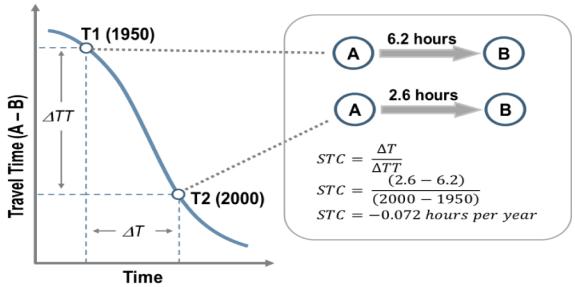

Fig. 2. Typical space / time Convergence speed profile (Source: Rodrigue, J.-P. (2020), Chapter 1)

Development sociologist ,Ankie M.M. Hoogvelt while discussing the deepening crisis of African society in his book, 'the third world in global development', for one, describes the new world order not as the traditional pyramid—with the core countries on top, followed by the semi-periphery, and then the periphery at the base—but as three-tier concentric circles. At the apex of Hoogvelt's schema is about 20 percent of the world's elite population, dubbed "bankable"—i.e., people whose economic contributions are such that any investments made on them payoff; followed by the "employable tier" of about 20–30 percent of the world population, people who are in insecure jobs, constantly thrown into competition in the global labour market; and then the zone of the "excluded," made up of about 50 percent of the world's population, who are "performing neither a productive function, nor presenting a potential consumer market in the present stage of high-tech information-driven capitalism", mainly found in Africa [43]. He re-emphasizes the assertions in his 2001 book, 'globalisation and the postcolonial world: the new political economy of development', that all the three circles in the development concentricity cut across national, continental, and regional boundaries, albeit in different proportions to their respective position in the international political economy [44].

John Agnew of the University of California at Los Angeles on his part, adds his voice on this line by arguing that the world is going through uneven development thereby creating "a complex mosaic of interlinked global city-regions, prosperous rural areas, resource sites, and 'dead lands' increasingly cut off from time-space compression" and instead being thrown into divergence limbo [45]. As with Hoogvelt's schema, Agnew's mosaic web cuts across national and regional boundaries. As he puts it, "even if there is a basic global north-south structure to the world economy some of the prosperous areas, for example, can be found within even the poorest countries [and vice versa]".Manuel Castells' book, 'end of millennium' , highlights the processes of global social change induced by the transition from the old industrial society to the emerging global network society in which he quips; "the ascent of informational capitalism is indeed characterized by simultaneous economic development and underdevelopment, social inclusion and exclusion, in a process very roughly reflected in comparative statistics" [46].

In a relentless fashion, John Agnew continues to drum up his view by pointing to us that, there is ongoing polarization in the distribution of wealth at the global level, differential evolution of intracountry income inequality, and substantial growth of poverty and misery in the world at large, and in most countries, both developed and developing. Joseph Mensah, while discussing the Africa's space in globalization paradigm, states that, notwithstanding the dialectical interpenetration of the global North and South, and regardless of how one slices the proverbial global pie, the vast majority of sub-Saharan Africans are among the "excluded" or those in the global "dead lands," virtually "falling out" of the network society. For the case of sub-Saharan African, Manuel Castells declares as having a very low technological base thereby inhibiting her functional involvement in the new high-tech economy of the new world order. The same theme permeates the pages of the annual Human development reports, as Leandro Prados de la Escosura found out in his 2012 summary paper for Africa [47]. In fact, he emphatically repeated that, almost any mention of sub-Saharan Africa in these reports alludes to a situation where the human condition on the sub-continent is in reverse of, or exception to, the general global trend. Consider the following excerpts from the numerous reports: "Since the mid-1970s almost all regions have been progressively increasing in HDI score. The major exception is Sub-Saharan Africa. Over the past three decades developing countries as a group have been converging on developed countries in life expectancy the exception again is Sub-Saharan Africa. For the region as a whole life expectancy today is lower than it was three decades ago. Income poverty has fallen in all regions since 1990, except in Sub-Saharan Africa. While the world as a whole is on track towards the aspirations to achieve the much-hailed Vision 2030 on Sustainable Development, more especially Goal 1 which focuses its attention to end poverty in all its forms everywhere but Sub-Saharan Africa region is sadly "off track" since many of her people still live below the poverty line [48].

The way Africa fares in terms of time-space compression innovations, is of great interest. From internet, cellular and landline telephone access indicator studies by many scholars, for example, Joseph Mensah's observations, it is clear that not only are sub- Saharan African countries worse off in Human Development Index (HDI), but they have very low time-space

compression innovations as well. He states, of the 177 countries ranked in the 2006 HDI, Niger came in dead last, and a whopping twenty-eight (of the thirty-one) low human development countries are in the region. Furthermore, with the exceptions of Botswana, Namibia, and the tiny islands of Seychelles, Mauritius, and Cape Verde, no sub-Saharan African country had more than fifty mainline phones per one thousand people by early 2000.The latter made earlier strides in establishing mobile phone networks in Africa. The fact that so many countries in the region, including Cameroon, Uganda, Rwanda, Angola, Chad, Central African Republic, Burkina Faso, Sierra Leon, and Niger, had fewer than ten mainland phones per one thousand people (or one per one hundred) two decades ago, is simply astounding in this era of time-space compression, Mensah added. In a more nuanced fashion, Manuel Castells wittily added his voice on this by stating, “there are more telephone lines in Manhattan or in Tokyo than in the whole of Sub-Saharan Africa.” The figures for cell phone are slightly encouraging, with many countries jumping from having virtually none in 1990 to more 50 or more cell phones per 1000 people in the years after 2000.

Arguably, no other technology grounds the working of the network society of today more than the Internet. In 1990, sub-Saharan African countries had virtually no internet connectivity as per historical records. After 2000, the region started recording some connections, but very rudimentary, with most countries having less than 50 Internet users per 1000 people. In fact, many have argued, sub-Saharan African had merely 19 Internet users per 1000 people, compared with 115 per 1000 for Latin American and the Caribbean; 55 per 1000 for the Arab States; and 91 per 1000 for East Asia and the Pacific Region. Clearly, “Africa at that time, by and large, was a switched-off region of the world” using Internet connectivity in the words of Manuel Castells. The IT lacuna in the region is far more systemic, going beyond mere shortage of Internet connectivity to a debilitating lack of computer infrastructure, training facilities, and consequently, basic computer skills among the bulk of the population [49]. The perturbation in all this is not merely that sub-Saharan Africa has extremely low infrastructural and technological base, vis-à-vis time-space compression, but also that the little available comes with exorbitant price tags, given the usual econometric tensions between supply, demand, and selling price.

Time-space compression facilities, including airline connections, Internet access, phone lines, cable television services, and even international travel visas, are hard to come by in many parts of the region. This scarcity creates avenues for price gorging and other exploitative tendencies among supplies. The difficulties black Africans go through in procuring visas are almost legendary in the unwritten annals of international travel. Beside high—and, arguably, bad-faith—visa application fees, African nationals seeking to travel overseas are routinely subjected to exceptionally excessive interrogations and medical examinations by various embassies. And the international racism often meted out to these people at major international airports (such as Skipol in Amsterdam, Heathrow and Gatwick in London, Frankfurt International Airport in Germany, and Toronto International Airport in Canada) are only now receiving some attention in the literature as per the 2020 paper by Antje Ellermann .David Harvey’s “spatial fix” explains that contradictions of capitalism which he adds, produce crises of overaccumulation (in the West),which then forces the capitalists to “capital switching,” or “spatial displacements through opening up new markets, new production capacities, and new resources and labour possibilities elsewhere.” There are indications that some capital switching—from Western Europe, the Middle East, and Newly Industrializing Countries (NICs)—are underway in the airline, Internet, and cell phone businesses in sub-Saharan Africa. This has created what Tom Burgis, terms as,’The Looting Machine: Warlords, Oligarchs, Corporations, Smugglers, and the Theft of Africa's Wealth’.

The exploitative maneuvers of some of these foreign companies are likely to engender yet new rounds of accumulation by dispossession on the African continent. In fact, according to Patrick Bond, despite the rhetoric, ‘Africa rising’, [50], the people of Sub-Saharan Africa are poorer [51]. This is despite the many efforts, like the Tony Blair's Africa Commission, the G7 finance ministers' debt relief, the Live 8 concerts, the Make Poverty History campaign and the G8 Gleneagles promises, to the United Nations 2005 summit and the Hong Kong WTO meeting, Africa's gains have been mainly limited to public relations. The central problems remain exploitative debt and financial relationships with the North, phantom aid, unfair trade, distorted investment and the continent's brain/skills drain [52]. Moreover, capitalism in most African countries has witnessed the emergence of

excessively powerful ruling elites with incomes derived from financial-parasitical accumulation [53]. Without overstressing the "mistakes" of such elites, this paper argues that Africa's wealth has been on the outflow mode [54].On the other hand, we also see a rise in manufacturing and industrialization because of Africa is copying the European Union's unification process through the Africa Continental Free Trade Area (Signe,2018).Through such initiatives, we are already witnessing seeds of urban agglomeration germinating, for example in East Africa region due to improved transport corridors (Palm et al,2011).The transport agenda for Africa is seen as the seed for structural transformation (Storeygard,2016) that will spur industrial growth (Pager,2018).

The ongoing effort to improve mobility in Africa is aimed at bestowing wealth in the hands of Africa. It is believed that, the evidence of David Harvey's capital switching theory is in exhibition in Africa but for all wrong reasons, mainly to promote capital flight out of Africa. According to this theory, capitalist production is divided into three interrelated circuits and argues that the oscillation of funds between them serves as an explanation to, for example in urbanization growth. The primary circuit is composed of the investment and production of consumer goods. The secondary circuit encompasses capital flows into the built environment essential to production (e.g., offices and factories) and to consumption (e.g., housing). The final circuit is composed of investment in technology and labour reproduction to enhance profits in the first two circuits. This is the point that Neil Smith offered a further operationalization through gentrification in the inner-city development [55]. He opined that the extent of underdevelopment state in a place creates conditions for development (e.g., in the form of cheap labour), and which further creates the tendency for capital to move from developed regions to underdeveloped ones and which may cause displacements, where rich individuals, take up spaces owned by the poor who are then forced to move to the outskirts of the city. Undoubtedly, the low technological base in Africa could create the conditions for such capital oscillation where the rich Westerns move in the Africa continent, but at what cost to the environment, to national sovereignty, land ownerships and to the overall development of the continent?

Already, we are witnessing gentrification in the African landscape, where we see, several countries have now granted full legal recognition to various types of private or otherwise nonstate conservation arrangements, thereby often seeking to create novel opportunities for ostensibly "green" capital investments in various for-profit conservation enterprises, see recent work by [56]. Howard French's book, 'the continent for the taking: the tragedy and hope of Africa' is concerned with the west's treatment of the continent as a place where genuine scourges exist—plagues of chronic hunger and preventable disease [57]. In fact, he has also written about China's influence on Africa incisively where he reveals the human face of China's economic, political, and human presence across the African continent—and in doing so reveals what is at stake for everyone involved. In a nuanced portrait, French reveals the paradigms forming around this new world order, from the all-too-familiar echoes of colonial ambition—exploitation of resources and labour; cut-rate infrastructure projects; dubious treaties—to new frontiers of cultural and economic exchange, where dichotomies of suspicion and trust, assimilation and isolation, idealism and disillusionment are in dynamic flux [58]. In section two of this paper, methodology is explained followed by results in section three and discussion in section four. Section five has conclusion.

All is not lost however, because we see the penetration of mobile phone telephony establishing some form of flexibility in interactions [59]. This is one important attempt that has recorded a reduction in the friction of distance within the African space thereby improving the quality of life of the people (Lee,2002).Typically, because of information communication technology, internet and mobile phone use ,we see today, an increased interactions hence fulfilling the adage of the inseparability of space and time in human life (Thrift,1977).What should follow then is to make the urbanization in Africa to work for her people in creating jobs and catalysing agglomeration as a by product of globalization the way it does in developed economies (Page et al.,2020).When this happens,globilization will influence social life in Africa as it does in politics (Henricksen,2002).Already, African leaders are working in creating economic blocks (Melo and Tsikalen,2014) and use of big data to accelerate distance decay as a demystification of Tobler's theorem on the distance-objects relationship, for he stated that only near objects are closely related, but S-T-C by way of technological

advancement has made everything close to each other (Han et al.,2016).

4. MEASURING SPACE-TIME CONVERGENCE

There are various ways of measuring place accessibility; Structural Accessibility Layer (SAL) public transport indicator and the Public Transport and Walking Accessibility Index (PTWAI) for any grid with a number of trip zones [60]. Todd Litman, the founder and executive director of the Victoria Transport Policy Institute, says, there are mainly three approaches to measuring transportation system performance which can influence planning decisions. Traffic-based measurements (such as vehicle trips, traffic speed and roadway level of service) evaluate motor vehicle movement. Mobility-based measurements (such as person-miles, door-to-door traffic times and ton-miles) evaluate person and freight movement [61]. Accessibility-based measurements (such as person-trips and generalized travel costs) evaluate the ability of people and businesses to reach desired goods, services and activities.

Accessibility is the ultimate goal of most transportation and so is the best approach to use which affirms Albacete findings [62]. In America for example, plans are underway to create "Interstate 2.0," a high-speed rail network reconnecting the center cities, major airports, and ports—thus recapturing the vital role of the intercity train, bus, and transit industries. This, the Americans say, will be an "ethical transportation system" whose characteristics include; (1) does not injure or kill; (2) does not pollute and is environmentally benign; (3) does not waste fuel; and (4) does not cost too much. It uses the strengths of each mode of transportation. They want to build a twenty-first-century intermodal transportation system using the "steel wheel and steel rail" as the fundamental element and they will electrify all of North American rail, thereby providing a new source of energy for their transportation system which soon will provide transport beyond oil which ultimately, will provide a faster space-time convergence speed in social interactions [63].

The dimension of space / time convergence is about the accessibility of places (i.e., how easily certain places can be reached) or of people (i.e., how easily a person or a group of people can reach activity sites). As shown in Figure 2 above, an individual's level of accessibility will depend largely on where activity sites are located vis-à-vis the person's home and the transportation network and, but it will also be affected by when such sites are open and even by how much time someone can spare for making trips [64]. Transportation engineers and scholars have long argued that the ease with which people can get where they want to go—in other words, accessibility should be considered in any assessment of the health of a place or any measure of the quality of life [65].

Hanson's [66] book argues that, measuring accessibility in a meaningful way can be difficult. In a multimodal trip distribution, it explains, one of the components of travel demand models is the estimation of the rate of decay with distance (or time) from an origin: the greater the separation between an origin and destination the lower the propensity to make the trip. Because time is the key indicator of separation in the utility of a trip maker and travel time and trip quality vary by mode, the decay function is expected to be different for different modes. Not only do travel speeds vary by mode but the choice of mode also partly influences locational decisions and individual willingness to make trips of certain lengths. For instance, households wanting to use transit (heavy rail in particular) are more likely to locate along major transit facilities. However, conventionally, trip distribution functions are estimated for automobile trips only and are applied to trips by all modes. The main justification for this procedure is that more than 80 percent of all trips are made by privately owned vehicles, and specific treatment of transit and other modes is not expected to improve model performance significantly.

In chapter 4 of the same Hanson's book, whose title as,'The Geography of Urban Transportation', Giovanni Circella and Patricia L. Mokhtarian explored the fascinating question of how information and communication technologies such as the Internet and mobile devices are changing the relationship between distance and accessibility, and therefore the relationship between accessibility and land use. They stated that, personal accessibility is usually measured by counting the number of activity sites (also called "opportunities") available at a given distance from the person's home and "discounting" that number by the intervening distance. Often accessibility measures are calculated for specific types of opportunities, such as shops, employment places, going to school or medical facilities. They came up with

the following formula for measuring accessibility, see page 12 [66]:

$$A_i = \sum_j O_j \, d_{ij}^{-b} \quad (1)$$

where A_i is the accessibility of person i,

O_j is the number of opportunities at distance j from person i's home, d_{ij} is some measure of the separation between i and j (this could be travel time, travel costs, or simple distance), and b is a measure of how quickly accessibility declines with increasing distance. Such an accessibility index is a measure of the number of potential destinations available to a person and how easily they can be reached. Accessibility is usually assessed in relation to the person's home because that is the base from which most trips originate; personal accessibility indices could (and perhaps should) also be computed around other important bases, such as the workplace [67].

In explaining, Hanson continues to state that the accessibility of a place (say a city) to other places in the larger space (say within African continent) can be measured by the same equation, with Ai now the accessibility of zone i, and Oj the number of opportunities in zone j . Although we can use the same equation, the difference between measuring the accessibility of individuals and that of places (or zones) within the larger space is important. When we measure accessibility at the level of places (say many African cities), the access measure treats all those living in zone i as if they have the same level of accessibility to activity sites in the in the bigger place; it does not distinguish among different types of people within a zone, such as those with or without a car. Both these measures of accessibility are highly simplified representations; neither really addresses mobility nor includes dimensions such as the ability to visit places at different times of day.

A third measure—that of space–time convergence—takes both accessibility and mobility into consideration; it is a more satisfying measure conceptually than measure (1) but far more difficult operationally. The concept of space–time convergence has been developed in the context of time geography and focuses on the constraints that impinge on a person's freedom of movement (Hägerstrand, 1970). These constraints include: Capability constraints —the limited ability to perform certain tasks within a given transportation technology and the fact that we can be in only one place at a time; for example, if the only means of transport available to you are walking and biking, the number of activity sites you can visit in, say, half an hour is lower than it would be if you had access to a car. Coupling constraints —the need to undertake certain activities at certain places with other people; for instance, that lunch meeting with your boss can only be scheduled when you both can be in the same place at the same time. Authority constraints —the social, political, and legal restrictions on access—for example, you can only see your dentist or go to the movies during the hours they are open, and certain locations are off-limits to people without access permits, for example due to emigration rules. Your access to places and activities is restricted by these constraints. A measure of an individual's space–time convergence is the space–time prism, a visual representation of the possibilities in space and time that are open to a person, given certain constraints.

This paper looks at space-time convergence from an accessibility lens and borrowing from (Piere,1979) review discussion on accessibility measurement. Accessibility, Piere quips, is invoked as a desideratum for physical planning, as an explanation for ground rent and home location, as a variable in trip-generation and mode-choice modelling and as a force behind real-income transfer. Accessibility has become a key concept for characterising a fundamental principle of human activity: maximum contacts through minimum activity. One way to measure accessibility is via the distance. In distance measure, the time that interest has been shown in quantifying accessibility several measures have been developed [68]. The simplest of these is one about 'relative accessibility'. Here the physical separation of two places is treated as the measure of the accessibility of one place to another: places far apart are mutually less accessible than places close to one another [69]. The measure is reflexive (the accessibility of a to b is the same as the accessibility of b to a) if the connection between the two places is not unidirectional. Physical distance, or time or cost distance may be used to measure separation. At a wider scale, the integral accessibility' of a place measures the accessibility of one place to all other places in some closed space. The measure is not reflexive and unlike the gravity measures discussed below, does not include attractor variables.

The other is the topological measures. In this, the distance measures of accessibility are generally similar to the older topological measures of accessibility in their not including attractor variables. Usually, topological measures of accessibility are derived by reference to just the presence and number of links rather than to the absolute distance between network vertices, but this is not strictly necessary. This method has been associated with the number of a vertex in a network. The yet another popular method of measuring accessibility is the gravity [70]. The gravity measure is made by coupling real internode distances on a network with a measure of the opportunity at, or attractiveness of, each other node of interest. The number of opportunities at one particular node (destination) discounted by the distance of the node from some reference point (origin) is a measure of the relative accessibility of opportunities at the destination node. On a broader canvas, measuring the total accessibility of all opportunities involves discounting the total number of opportunities at all nodes in a specified area by the sum of the distances between the reference node and all other nodes in turn.

A fourth kind of accessibility measure, cumulative opportunity, indexes the accessibility of various opportunities according to the number which can be reached from the origin of interest within specified travel distances or times. The method works with an inverted measure of cumulative opportunity, calculating the number of zones within given travel distances and times from one destination. Notice that the cumulative-opportunity measure of accessibility does not discount measures of opportunity over distance. In consequence the accessibility enjoyed at an origin is allowed to increase as travel distances increase; this usually occurs at a decelerating rate. An obvious deficiency of cumulative-opportunity measures is the arbitrary selection of the isochrone (or isodistant) of interest and the lack of differentiation between opportunities which are adjacent to the origin and those just within the isochrone of interest.

This paper has the view that space-time convergence is a measure of accessibility because it provides opportunities for easy interaction or exchange the context of space geography. In that way, the paper has attempted to present the African space-time convergence status using different techniques provided by different experts for measurement of accessibility in literature. First it uses the Hanson formula analysis to interpret accessibility measurement and perspectives with a glance in the Africa mobility literature. A look at the literature revealed a wealth of information regarding the theory and specific construction of accessibility measures, which can help policy makers gain a better understanding of the strengths and weaknesses of each method when they are used for mobility planning and management.

5. RESULTS

Everyone at day break has 24 hours to budget between gainful employment, domestic chores and other social activities, for example handling children schooling, entertainment, shopping etc [59]. There are two central concepts in time budget, which are; the space time path and the space-time prism. Figure 3 illustrates a space-time path among activity locations or stations in two-dimensional space and time, with time represented by the z-axis orthogonal to the plane. Note that the path is vertical when the individual is stationary at an activity location and becomes more horizontal when he/she is moving through space. The slope of the path is a function of the apparent movement velocity, i. e., the trading of time for space allowed by the available transportation resources within that environment. Cylinders represent the activity stations in Fig. 3: the length of each cylinder with respect to the z-axis indicating its availability in time [71].

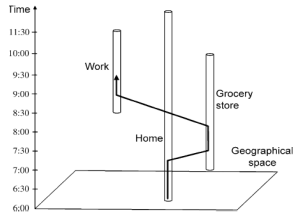

Fig. 3. A space-time path (Source: Miller, H. J. (2017)

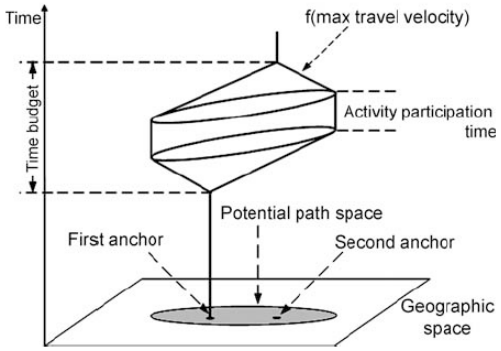

Fig. 4. A space-time prism (Source: Miller, H. J. (2017)

In Fig. 4 we see an illustration of a space-time prism with the space of movement being cast down on a 2-dimensional plane. The y- axis demarcates the possible locations for the space-time path within a time budget and is therefore a direct measure of a person's accessibility to the environment and activities. Fixed activities anchor a spacetime prism since by definition these allow only one spatial possibility during their duration. For example, the first anchor in Fig. 4 could be the person's home while the second anchor could be their workplace. At some time during the time interval between when the home activity ends and the work activity begins, the person wishes stop at some location to conduct an activity, e. g., shop at a store. The available time interval is the time budget for the travel and activity episode. Given these anchoring activities, the time budget, a maximum velocity of movement and the required activity participation time, the prism determines the locations in space and time that are available to the person. The region inside the prism comprises locations where an individual could be at different times during that episode. An activity is not accessible to this person during this episode unless its location and duration intersects with the prism to a sufficient degree, with this determined by the minimum time required to conduct the activity. Similarly, two people cannot meet unless their prisms intersect to a sufficient degree. The projection of the prism to the two-dimensional plane is the potential path area: this comprises the region in geographic space where the person can be during the entire time interval.

6. DISCUSSION

Fig. 3 above, for example, shows the space–time convergence for a person who is currently (at 6:00 A.M.) at home and who must arrive at the workplace no later than 8:30 A.M.; the distance between these two locations is shown on the "space" axis. Somewhere in between he must stop at a food store to buy some groceries. In addition to these location and time constraints, the person in this example must conduct all travel either on foot or by bicycle. The slope of the lines in Fig. 4 shows the maximum speed (presumably by bicycle) that he can travel. The prism outlines the envelope within which lies the set of all places that are accessible to him given these constraints. If no food store selling what he needs exists on the way (shown on the "space" axis), then he lacks accessibility in this instance.

The concept of a space–time prism also illustrates how changes in constraints can affect accessibility. If, in this example, the grocery store were to open earlier say 6:30 A.M., the prism defining the set of possibilities would be enlarged and this person's space–time convergence would be increased. Or suppose the person travelled by car: he could then travel farther in the same amount of time, and the prism would therefore be larger.

Many factors can, then, affect space–time convergence speed. For example, flexible work schedules, longer store hours, and purchasing an additional family car all enhance space–time convergence by adding margins to the space–time prism. Lower speed limits, rigid grocery opening hours, and traffic congestion all constrain choice. Large families impose coupling constraints, which often affect women more than men. Babysitters, day care centers, and children's growing up all reintroduce issues of space–time convergence for parents. You can see that measuring space–time convergence by including all of these relevant factors would be

complicated; nevertheless, the concept has been influential in thinking about transportation planning. Increasing people's space–time convergence seems desirable in that it implies a greater accessibility to places and more discretion for spending one's time. We might question, however, the need for ever-increasing space–time convergence and ever-increasing personal mobility. Transportation geographers among others have begun to ponder whether or not there is such a thing as too much mobility.

In the African travel history, Ann Jones 'book, 'Looking for Lovedu: Woman's Journey Through Africa, paints the history of travel across the continent as daunted with frustrations, see Fig. 5 from South Africa to Morocco which took extremely long [72].

Travelling across Africa is recorded as gruelling and dangerous and the travellers needed a friend and protector in the account of Klaus Braun and Jacqueline Passon, in their book,' Across the Sahara: Tracks, Trade and Cross-Cultural Exchange in Libya' [73]. This situation has improved but is still a challenge as recorded by Porter and colleagues who discussed the young people's daily mobilities in the Sub-Saharan Africa. Without a doubt, since the early 1970s, there has been an increased mobility and internationalization of social, economic, and cultural practices, with different scholars zeroing in on different aspects of the ensuing phenomenon in the available literature [74]. With the concepts of time-space convergence, space of flows, and timeless time, Harvey and Castell (and many others) have highlighted the dramatic restructuring of our spatiotemporal dimensionality and of our experience of it. Ironically, just as time seems to conquer space in the time-space compression underway, emphatic assertions of the end of history are not uncommon in the literature. But as John Agnew sarcastically puts it, "history has not ended in instant electronic simulation. History is not the same as the History Channel." In a similar ironic vein, with the annihilation of space (by time)—and the attendant talk of an emerging placelessness—has come a growing concern about space and geographic differences, not only among social theorists, but also among capitalists, for whom miniscule spatial differences have assumed even greater importance. With the aid of empirical data on time-space compression technologies, such as telephones, the Internet, and electricity, this paper has shown that the processes of globalization are hardly uniform across space (Rodrigue, 2020).

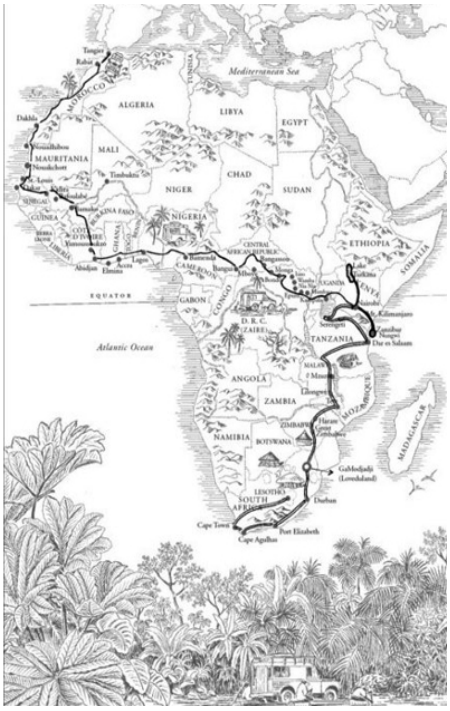

Fig. 5. Road travel across Africa (Source: Klaus Braun and Jacqueline Passon, Across the Sahara: Tracks, Trade and Cross-Cultural Exchange in Libya')

The character(istics) of individual places or regions interacts with globalization to yield specific outcomes in the network society [75]. Different social groups and regions are differently positioned on the axis of globalization, with race, ethnicity, class, gender, age, and other variables of social domination (and their permutations) influencing people's ability to negotiate the topographies of time-space compression. Africa as a whole—and sub-Saharan Africa, in particular—lags behind the rest of the world in nearly all the major indicators of the network society, with some even describing the continent's tie to the global economy as one of excorporation rather than incorporation [76]. Still, we must note that not all African, or for that matter sub-Saharan African, countries have "fallen out" of the network society. The sheer size and complexity of the continent make any such generalization patently facile. Inter- and intranational variations abound on the continent, as one would expect of any part of the world. Similarly, it would be erroneous to paint an image of sub-Saharan Africans as though they are totally powerless in the network society, with no human agency of their own.

As Foucault [77] taught four decades ago, power is indeed pervasive, because it hails from all-around, and without resistance, defiance, and subversion, power becomes impotent. As several authors including Mensah have demonstrated, Africans have not only participated actively in globalization, but have mounted various resistance forms, when need be, to protect their individual and collective interest. Unfortunately, some aspects of this agency have been criminogenic—then, again, Africans are hardly the only people implicated in criminal activities in the network society. The human agency exhibited by Africans in this context should not impair our vision of the power imbalance inherent in globalization and its space of flows. The handiwork of Doreen Massey [78] in particular, while almost everyone is somehow caught up in the processes of globalization, some are more in charge than others [79]. Africa, however is caught up in territorial power control which limits the speed of space-time convergence. So, you find that, the transport infrastructure is in a poor state and the delay in many police road blocks and at border controls are also lethargic, see Fig. 6. As said, a picture speaks more than a thousand words, the police road block in the picture is an extortion petty corruption on motorists, and such is common in most African road networks [80]. This contributes to delay on the road and reduction of space-time convergence speed.

This power imbalance even extends into the discursive practices surrounding globalization, making particular observations about globalization more (un)fashionable than others. To the extent that the prevailing knowledge about globalization paints a picture of an unfettered mobility of goods, services, and labour in a shrinking world—an image which is evidently far from what exists in Africa, and perhaps the global South in general—there seems to be some element of what Gayartri Spivak [81] might call "a successful cognitive failure" (if not false consciousness) in operation.

Fig. 6. Travel on Libyan roads is subject to frequent police checks
(Source: cover page, James McDougall and Judith Scheele (2012). Saharan Frontiers: Space and Mobility in Northwest Africa. Indiana University Press) [82]

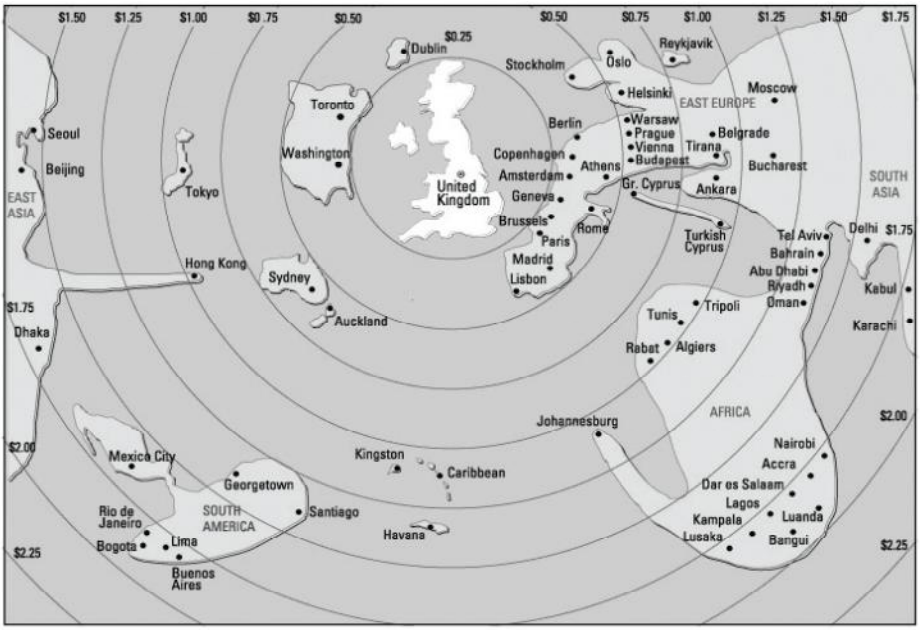

Fig. 7. Example of a Map of Telephone Cost Space Showing the Price per Minute in US$ of an International Telephone Call from the United Kingdom in the Year 1998
(Source: Tele Geography Research, Tariff Map United Kingdom 1998, http://www.telegeography.com/ee/free_resources/figures/tarrif_map-04.php)

In everyday life, we are not consciously dealing with separate concepts of space that change and adjust when we look at a different issue. Rather, our general image of space tends to be multi-faceted and somewhat blurred by accommodating a multitude of different relational patterns at the same time. While such a concept of space works absolutely satisfactorily and flexibly in daily routine, it cannot serve as a basis for academic analysis. Therefore, this paper suggests thinking of space as a theoretically infinite number of spaces defined by the present research questions and scientific interest. The nature of relations between the individual objects defines the nature of space – and there are as many possible spaces as there are potential sorts of relationships [83]. From this perspective, geographic space is but one variety of space in which objects are arranged according to their geographic distance [84]. Some eclectic examples for other spaces could be: - communication space: how long does it take to communicate between two objects (e.g., people, apparatuses, institutions)?- transport space: how long does it take to transport something specific (e.g., mail, cargo, people) from one place to another? - telephone cost space: how much does it cost to make a telephone call between two locations? - transport cost space: how much does it cost to transport something specific from one place to another?

As can be seen in these examples, the question defines the relation between objects and, therefore, the nature of each particular space. In fig. 7 above, an extract of telephone cost space is represented [85]. The places on the map are arranged according to the amount of money it cost to make a telephone call from the United Kingdom to that particular place in the year 1998. As the visualized data focuses exclusively on calls from the UK, the map shows only a specific detail of telephone cost space – but this is enough to illustrate that it is fundamentally different from geographic space. The locations of, for instance, Australia or Japan in fig. 7 are clear testimony to this.

7. CONCLUSION

It has not been the intent of this paper to tease out the fine-grained variations in time-space convergence innovations or to uncover the root causes of sub-Saharan Africa's weak attachment to the network society. Still, it would not take much forensic theorization to establish that the usual "suspects"—including political instability and cronyism, deteriorating terms of trade,

rampant tribalism and ethnic conflicts, excessive foreign debt burden, and subtle and not-so subtle looting by Westerners and their African allies, and so on—are all implicated, in one way or the other [86]. The paper's aim here is to sound the alarm bell to the powers that be in sub-Saharan Africa to reverse Castells' prediction of an impending "market deepening" which argues that about one-fifth of the world's population continues to do better, while about 40 percent of the world's population, many of whom are very likely to be sub-Saharan Africans, continue to be excluded from the network society [57]. Pundits are banking their hope in the African Continental Free Trade Area (AfCFTA) whose potent to catalyse Intra African trade is billed huge as recently reviewed by Fe Doukouré Charles and Evan Lau , 2021's work [88]. If embraced well, the empirical findings which paint the transport infrastructure as poor on top of border restrictions challenges may become less deterrents to trade expansion endeavours in Africa. The application of Equation 1 in defining Africa's space time convergence will also become possible going forward in the face of her growing urban agglomeration. And more specifically, the continent of Africa should ideally have no geographical border to allow seamless transport system (mainly land transport). In simple terms, Africa, if it were possible should have an integrated regulation (i.e., cross border control management) to ease up transport logistics hence accelerating S-T-C speed. For now, the efforts are still a pipe dream if the blue prints are not implemented fully especially, the Trans African Highway Network.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Author has declared that no competing interests exist.

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