The Railway Transport System and the Integration of the Inland Container Depot to Reduce Co_2 Emissions in Africa

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Abstract: **Most of the rail systems in Africa were constructed in the early 20th century by the British colonial powers to facilitate the transportation of military troops into the interior of a country, and the movement of mining and agricultural consignments as well. However as soon as the continent gained its independence, railway links were divided into new national borders. Currently, the transportation industry especially the cargo and passenger transport that amounts for a high level of Greenhouse gas (GHG) emissions in the world. Furthermore, air pollution is also on the increase in Sub-Saharan Africa. International organizations and governments have understood the importance of reducing CO_2 emissions in developing national economic and energy policies. However, such decrease needs evident know-how of the pattern of CO_2 emission and its monitoring as well. More so in all the sectors of a nation, the transportation sector arguably is the sector that emits the most global CO_2. Thus, according to the international energy agency (IEA), the industry emitted approximately 23% of global greenhouse gas emission in 2013 which led to the adoption of many climate change regulations. In Africa, the view is that coastal ports are now moving away from the command and control approach of management towards a more decentralized and collaborative approach. The government is not solely in control of the coastal port environmental direction, due to the increasing demand for global best practice in port operations. Using past research carried out and descriptive case studies, the different investigations have tried to forecast the possibility for a modal shift from the road to the railway transport system. The investigations carried out are primarily different in terms of methodology, assumptions, and findings. The literature provided a summary of the studies that have tried to forecast the possibility of a shift from road to rail in coastal port cargo distribution. However, most of the studies were conducted in Europe and America with a few in Africa in the area of freight transportation. The findings revealed a high percentage of modal shift possibility while the descriptive case studies suggested the implementation of the railway system and the integration of the inland container depots for transportation of long-distance cargo from the coastal ports to the hinterland to reduce CO_2 emission.**

Keywords: **Railways, Coastal Ports, inland depot, containers, emissions, environment, transportation, integration, CO_2**

I. INTRODUCTION

The transportation industry especially the cargo and passenger transport amounts for a high level of Greenhouse gas (GHG) emissions in the world. Furthermore, air pollution is also on the increase in Sub-Saharan Africa. This situation is viewed to be caused by the extensive use of fossil fuel in the transport system, especially in the inland transportation system. More so, Africa has maintained low GHG emission in the past, but records have shown the rapid growth of CO_2 emissions in the environment [1]. Which can be suggested to be because of increased use of fossil fuel, and a high percentage of reasonably used vehicle imported from developed countries. The inadequate use of the railway system, which arguably emits the lowest level of CO_2 in the domestic transport distribution, the continued use of poorly maintained trucks on the road an increased emission from vehicle exhaust, which is estimated to have caused approximately 49000 deaths per year in the region is an issue of concern [1]. More so carbon emission from vehicles and other transport systems are viewed to have direct and indirect effects on the ecosystems, food production, and raw material production [1]. It could be argued, therefore, that global warming solutions can rely on the reduction of carbon emission in the environment. This paper will stress the significance of the ability of coastal ports interior access that can be achieved through the development of technology-driven inland intermodal terminals or inland container depot connect by rail that will enable the cargo handling process to be more seamless and efficient. Thus, motivating the modal shift of cargo volume from the road to more energy efficient transport system(railways) to reduce CO_2 emission in the environment. The paper discusses the railway system and inland container depot connected to coastal seaports to reduce CO_2 emission in Africa using the literature review and the descriptive case analysis to make conclusions.

Most of the rail systems in Africa were constructed in the early 20th century by the British colonial powers to facilitate the transportation of military troops into the interior of a country, and the movement of mining and agricultural consignments. However as soon as the continent gained its independence, railway links were divided into new national borders [2].

Furthermore, the railway transportation industry is viewed to be ripe in developed countries which are witnessing a remarkable growth after a period of decline. The rejuvenation of the rail industry is because of the discovery of its ability to transport large volumes of cargo or passengers with less $C0_2$ emission to the environment. However, in some countries

especially in Africa, railways are still battling to sustain themselves from subsidy dependency to a more robust commercial hub [2].

Even though, a few African countries are striving to improve their railway services to facilitate cargo distribution. For example, South Africa and northern Africa are doing well to sustain the development of the railway. Nevertheless, the railway system in Nigeria is viewed to be left behind with the emphasis that poor economic, political will, corruption, technology, and institutional condition have further worsened the dilapidating condition. However, currently, the Nigeria government have engaged the Chinese companies to reconstruct the railways with recent construction going on in the passenger rails. More so, the Nigerian government and China is in talking terms regarding the construction of the coastal railways in the past four years. That led to the signing of a contract agreement at the cost of 11.1 billion dollars which will cover the rail tracks to connect the coastal ports to the hinterland [3]

Africa as a continent is witnessing significant economic, social and infrastructural growth which are viewed to create a framework for the rail system to play a unique role in the transportation system. Thus, it can be argued that the development of big cities, increased population, the introduction of mining activities and the busy interregional corridors are elements that can facilitate the rejuvenation of the railway system in the 21st century. Furthermore, the new order has attracted the interest of many government authorities in Africa, international financial institutions (IFIs) and international investors currently as well [2]. The fast-growing phenomenon in greenhouse gas (GHG) emissions currently is an issue of great concern to climate change problem in the world. Many laws to control CO_2 emissions that are significant to global warming are developed continuously. These laws vary in different nations or different regions [4].

Nevertheless, the differences these laws can show is in the various will power demonstrated by the nations that are, toward addressing the plague of global warming and import/export trading [5].

Furthermore, international organizations and governments have understood the importance of reducing CO_2 emissions in developing national economic and energy policies. However, such decrease needs evident know-how of the pattern of CO_2 emission and its monitoring as well. More so in all the sectors of a nation, the transportation sector arguably is the sector that emits the most global CO_2 emission. Thus, according to the international energy agency (IEA), the sector emitted approximately 23% of global greenhouse gas emission in 2013 [6]

Many climate change regulations have been developed and implemented in the maritime industry. For instance, the first law adopted to control global climate change by the international maritime organization entered law in 2013 [7]. Furthermore, with a consistent call from the European Commission to make it mandatory for monitoring, reporting and verifying CO_2 emissions for ships calling at various ports in the world is significant.

Consequently, as container shipping rate continue to increase the connection with the interior, is a significant factor for the coastal port competitive benefits. Thus, real improvement centred only in the shipping aspects of the transportation chain and in coastal port terminal alone without considering the improvements in the coastal inland areas is a disadvantage to the functionality of the whole transportation chain. Moreover, the effectiveness of the railway system is required to facilitate the increasing rate of cargo as recommended by stakeholders in the transport industry [8]. However, the modal share of rail and road for instance in Europe is separate as a result of the removal of trade barriers and liberalization of the transport industry. Thus, leading to the growth in use of the road transport system. More so, a shift in the geographic mentality of trade (from east to west) is viewed to be a contributing factor to the change as well. These are seeming, due to the lack of adequate connectivity by railways to the market compared to the flexibility of the road transportation offered [9].

In Africa, the view is that coastal ports are now moving away from the command and control approach of management towards a more decentralized and collaborative approach. The government is not solely in control of the coastal port environmental direction, due to the increasing demand for global best practice in port operations. For instance, the port of Abidjan (ivory coast) have witnessed much state-centrism that has led it to pursue international management standards IS09001 and 1400 certification to show its full compliance to pollution control especially CO_2 emissions [10]. Similarly, the international regulation that demands the implementation of the MARPOL convention was adopted by the port in Tema (Ghana) in which they immediately initiated the BWMC '04 in the absence of national regulation. Also, the environmental reform in the West African region has been further encouraged by the presence of multinational terminal operators that carry out training and development programmes to disseminate knowledge in the environmental new standards and practice without depending on the government. The coastal port of Lagos Nigeria, for instance, is a significant beneficiary of the presence of the multinational terminal operators in contributing to environmental policy adoption and implementation [10].

II. LITERATURE REVIEW OF STUDIES ON TRANSPORT SHIFT FROM ROAD TO RAIL

Different investigations have tried to forecast the possibility for a modal shift from the road or air transportation to the railway transport system. The investigations carried out are primarily different in terms of methodology, assumptions, and findings. The literature intends to provide a summary of the studies that have tried to forecast the possibility of a modal

shift from road to rail in which most of the studies were conducted in Europe and America with a few in Africa in the area of freight transportation to reduce CO_2 emission.

Vassallo and Fagan (2007), in a comparative analysis, found that the share of rail load transportation in the united states is 40% which is far higher compared to the share in Europe and other developing countries. Factors such as competition from water and pipeline transport, shipment distance and commodity mix are responsible for the difference in the share of rail cargo between the United States and Europe. For example, the coastal and inland waterway transport according to Vassallo and Fagan transports approximately 45% of the entire cargoes in the EU compared to approximately 20% in the U.S which is due to a far longer coastline in the EU. However, in the US shipping distance is viewed to be higher than in the EU for many categories of consignments. Thus, arguing that on a longer distance, the railway system is competitive particularly in the US. Thus, suggesting that an average distance for rail and road cargo transport is approximately 400km and 150km in the EU. The researchers concluded in their investigation that in the US the share of rail load is higher in the category above 1000km while the share of rail in the EU is lower in the freight category between 500-1000 km [11].

Similarly, in a researched conducted by the world bank (2006) on the sub-Saharan Africa railway concession, which indicates that the rail sector is arguably the most cost-effective transport mode in the movement of non-time sensitive bulk cargo bulk on a distance of more than 500km [12]. Pittman (2007), is of the view that density can be used to determine the cost-effectiveness of the railway transport system over long distances categorized by high fixed infrastructural components [13]. Simuyemba (2007) observed, however, that the density of railroads in Africa has reduced due to the growing movement of cargo traffic from rail to road transport [14].

Furthermore, in 2008 the Zew study was conducted that involved the calculation of the GHG emission reduction potentials of two policy measures. The road infrastructure charges and the strategic approach to attaining an average rail speed of 80 km/h to motivate the modal shift from road to rail in Germany were investigated. Thus, in 2005 the road use charge was implemented for trucks with a gross weight above 12tonnes — the charge where between the range of 9-14-euro cents. The study was based on an econometric analysis of an empirical review that studied 500 German freight forwarders. The combination of different attributes revealed that the charge led to a 7% growth in road transport cost alone and a 0.8% increase in the cost if two transport systems are combined. The research also found that the 80 km/h speed will reduce the time duration of the primary transport carried out by rail to approximately 52% and by approximately 24% in combined transportation. Suggesting that the analysis can be applied across the globe since the price and speed effect was approximated to impact the entire railway carriage of cargo [15]

III. DESCRIPTIVE CASE STUDIES

Transportation shift in Switzerland shows that in 2006 about 25 million tonnes of cargo is suggested to have entered the Swiss Alps by rail, a railway transport share of 66%. These are arguably the highest share carried by railways on the European transport strip. Thus, showcasing Switzerland's commitment towards the move to the railway transport system in the vulnerable Alpine ecosystem. The Swiss government is viewed to have treasured the shift of an environmentally friendly efficient transport system into their constitution in 1994, in a voting arrangement for the 'Alpine initiative' and adopting measures such as; the introduction and funding of a new environmentally friendly rail infrastructure approved by the general degree on the 29th .11. 1998. The approval of the transalpine rail link was to cost approximately CHF 18.5 billion (11 billion Euro), which is approximately 1% of the GDP of the country [16].

Furthermore, the introduction of the Heavy Vehicle Fee (HVF), which was another measure introduced by the Swiss government in 2001 to curtail the activities of vehicles and truck with a gross weight of over 3.5 tonnes, viewed to be emitting high-level GHG in the environment. The HVF is viewed to be a vital strategy to motivate the shift in cargo transportation from road to rail and as well encourage the railway system to be the preferred choice of transportation from the coastal port to the hinterland [16].

The impact of the strategy employed by the transalpine through Switzerland suggests that between 2000 and 2008 the number of trucks traveling through the Swiss Alps, reduced from 1.4million to 1.7million which is approximately 9% decrease. However, without the implementation of the HVF and other measures, the figures would have been 1.6 million. Nevertheless, the documented transport shift has been viewed to have been motivated by Switzerland's policies characterized by a well-organized railways system operated in both domestic and international traffic corridors which are producing a good result in the transport market [16].

Consequently, in the whole of the African continent, the share of rail transportation has declined drastically in recent decades, owing to the stiff competition of the road transport system. However, one of the areas where the railway transport system has maintained its relevance and some areas expanded its market share is in the area of import and export flow via European coastal ports. For instance, the South African cargo transportation system is presently known for its ability to transport a high amount of export minerals [17]. However, the deregulation of the cargo transport sector resulted in an increase in the number of cargo vehicles in the transport market, unusually long distant trucks [18]. More so the lack of adequate financing for the railway transport system by the government is an important attribute that contributed to the dilapidation of the rail service in Africa [2].

Furthermore, the global economic advancements have led to a drastic growth in the flow of transportation particularly from south-east Asia to Europe with its entry from the coastal ports of Rotterdam, Antwerp, and Hamburg. More so, the container transport system has witnessed enormous growth across the world in main coastal ports. However, port-related activities remain very important in the market for the railway system to prevail. For instance, in Belgium, more than 50% of the import and export commodities transported by railways originated from the coastal port of Antwerp [16].

Finally, a critical example of a coastal port with a good railway connection but without a capable inland container transport infrastructure is the port of Barcelona. The port recorded a modal split of 95-5% in 2009 between the road and rail due to factors such as the availability of rail infrastructures, the high concentration of cargo at the coastal port ports with less moving into the hinterland and the distance from the main coastal ports to the hinterland [16]. These are all factors faced in the African continent that require a drastic overhaul of the system.

3.1 Intermodal transport arrangement

Intermodal transportation arrangement is viewed to be the technology trending in the delivery of containers globally. Shipping companies put in much effort to achieve economies of scale for the overseas area of their transport arrangement and to meet the demand for effectiveness, capacity and short lead time especially in transit through coastal ports and for distribution of cargo to the hinterland area of the coastal port [19]. To motivate the introduction of a hitch-free intermodal transport arrangement and to reach market demands on the coastal ports, the concept of the inland container depot otherwise known as(dry port, inland port etc), need to be established in the interior of a nation based on its coastal port directly linked to the railways to the intermodal terminal, or a facility where stakeholders engaged in shipping business, a place they can drop and pick their standardized containers in a similar way like the coastal seaports [20]. The benefit is to direct cargo movements to fewer transport passages to aid the movement of more consignments into the hinterland location and to reduce transit time through the coastal ports [20].The Transportation system of many nations is mostly designed according to their geographical situations, as well as their desire for the industry. More so fright rate is the primary determinant of the quality of services. Currently, environmental problems contribute significantly to the design of transport infrastructure across the globe. Thus, Suggesting that to achieve the desired adequate transport system, the railway system needs to be introduced to facilitate inter-modality. Intermodal transportation according to the European Commission (2000), is 'the combination of two or more transport mode in which the consignment is transported in the same transport unit throughout the journey.' Thereby reducing the rate of energy consumed, optimization of the use of different transport mode, reduction of port congestion and reduced environmental effects through the inter-modality of the road to rail transport [21].

Coastal ports are significant elements in the intermodal transport system. Their previous narrow outlook, especially in the aspect of fright handling, has encouraged the development of a range of different activities carried out in the ports. However, changes have also revolved around the need for shipping companies to offer more technology-driven transport system especially in the concept of the door to door transport solution rather than concentrate on the port to the port arrangement [22]. The view is that it will open the coastal port's hinterland and in return create port competition in the region.

The significant challenges coastal ports witness currently due to the increasing rate of containerized shipments is the absence of space at the coastal port terminals and the growing bureaucracy in the land side transport system required to serve the coastal ports. For many coastal ports, the most disadvantaged connection in their transportation arrangement is the lack of alternative means of transportation in which congested roads or inappropriate connections result in the delay thereby increasing the cost of transportation for customers. Thus, it can be argued that the strategic resolve is to introduce the railways' system and the integration of the inland container depot to service the ports which will, in turn, reduce CO_2 emission by trucks and reduce congestion as well. Figure 1: below shows the Greenhouse gas emissions from transport by mode in 2014 and Share of transport energy demand by mode in 2014 (%) which shows that 0.6% is the GHG emission by railways and 72 — % by road. Thus, the share transport energy demand shows that railways demand is 1.6% and 73% for road energy demand [23]. Figure 2; on the other hands shows clearly trucks emitting a high level of CO_2 in the environment.

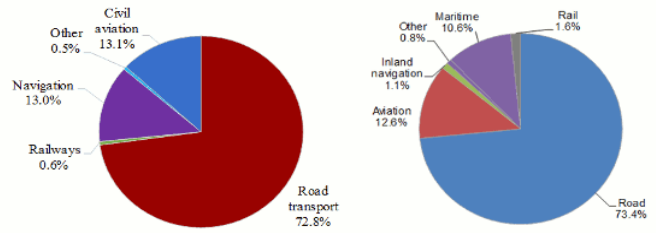

Figure 1: Greenhouse gas emissions from transport by mode in 2014/ Share of transport energy demand by mode in 2014 (%) [23]

Figure 2: picture showing a high level of carbon emission by trucks (Source: Author's research 2018).

Furthermore, the intermodal container terminal system has received considerable attention in the area of transport research. Significant investigations have been carried out in the area of identifying the optimal location for the intermodal terminal facilities and how to develop the competence of the road-rail terminal facilities as well [24]. A past investigation conducted by Slack (1990) illustrates the significance of the development of the inland load center for intermodal transportation [25]. In another investigation by slack (1999), the finding revealed that the inland intermodal terminal such as inland container depots located in the interior of a country connected by rail plays a significant role in reducing environmental pollution. thus, suggesting that coastal ports consume a lot of space and land in the metropolitan area of a coastal state. Arguing further that the expansion of these ports brings about environmental and land use problems. Thus, concluding in the research that satellite terminals, in other words, inland container depots can be a solution to accommodate coastal port expansion [26]. Nevertheless, with the significant role the inland container depot can perform in the intermodal transport network, they can arguably have an adverse effect as well on the growth of transportation. For instance, additional trans-shipment expenses at road -rail terminals or for lack of shipper's knowledge to choose the appropriate transport mode once they relocate their business to the intermodal transport location [8].Consequently, the growing concentration of GHGs reveal a high growth rate from 278 parts per million (PPM) for CO_2, 722 parts per billion (PPB) for CH4, 273 parts per billion for N_2O in the year 1965 and showing an increase of 379 PPM, 1,774 ppb,319 ppb respectively in 2003 according to a research conducted by Forster et al (2007) [27].

Furthermore, the high increase of CO_2 concentration is viewed by researchers to have an impact on radiative forcing which was observed after the industrial revolution — arguing that approximately 75-80 percent of anthropogenic global warming is caused by CO_2 concentration — suggesting that the atmospheric CO_2 level has been on a steady increase globally over the years compared to the past 420,000 years [28]. Thus, according to emission scenarios, the forecasted increase in co concentration is expected to exceed 450ppm by the year 2050 [29].Thus, the need to control GHG emissions in the environment to below 490 ppm CO_2-eq emission is currently significant and to further reduce it to below 50-80 percent emission by 2050 [30]. That would help to achieve the 2^0c pre-industrial limit on global warming. In which the transportation industry is viewed to be a significant contributor to carbon emission in the environment [30].Furthermore, coastal port infrastructures and activities are viewed to be dangerous to the environment as it can result in the modification of water systems and the interference of hydrological processes[30]. Thus, the expansion of the port infrastructure around the sea to increase its capacity poses a threat to the environment. According to the fifth assessment report from the inter-governmental panel on climate change (working group 1), observed that human influence is a global factor on climate change that is known (IPCC, 2013). However, the use of energy is by far the highest source of GHG emission to the low rate on human influence such as agriculture producing predominantly CH4 and N2o from domestic animals while the cultivation of rice without energy-related processes emits predominantly Fluorinated gases and N2o [31].Consequently, the energy and transport sector according to findings by researchers suggests that emissions from the oxidation of carbon in fuels during combustion are the highest in the total GHG emissions globally. Thus, suggesting further that the sectors emit approximately 58% of anthropogenic GHG with the view that the demand for energy and transportation is on the increase globally due to economic growth and development with more reliance on fossil fuel of approximately 150% between 1971-2015.as suggested by the Global Carbon emission from Fossil Fuels (Source: Boden, T.A., Marland, G., and Andres, R.J. 2017)

3.2. Measures to reduce C02 emission from shipping related activities

The coastal port can play a vital role in reducing the level of CO_2 in the shipping transport industry in different ways. Coastal port is viewed to be directly affected by carbon emission from a vessel and other maritime transport activities; these environmental discharges from vessels represent the primary source of air pollution. The key to reducing carbon emission is vital for instance. Shore power facilities are arguably a dynamic way to help in the reduction of GHG these power facilities represent approximately 5% of GHG emitted by vessels in the port awaiting discharge of cargo [32]. However, coastal; port can have a more impactful role in the reduction of emission from vessels. In such a way they could mandate shipping companies and motivate them to follow a laydown procedure towards a decarbonization pathway. For instance, the introduction of financial incentive as a strategic measure [32]. More so, according to the report by the international transport forum (2018), stated that about 30 out of 100 coastal ports globally use the financial incentive as a strategy to the decarbonization of the maritime transport industry, especially in OECD nations. Some small ports around the world also use the strategy as well. Suggesting that the regular incentive employed by most coastal port is the green port fee, that is based on an index that shows the environmental performance the vessel calling at the port. Nevertheless, financial incentives such as the reduce speed, green berth-allocation, green procurement, and local/regional carbon pricing mechanism are also strategies that can be used to reduce CO_2 emission, but they are hardly patronize in ports around the world [33].

Consequently, alternative fuel and energy according to the International Transport Forum (ITF) report (2014) can be another measure in the area of port-based incentive. More so, past proceedings recorded in the transport industry suggest that more emphasis globally was on sulphur from the vessel. However, the coastal ports engaged in encouraging the shipping company to consider using alternative fuels

voluntarily by offering an incentive to the companies to switch to low sulphur fuels. An example of the programme carried out by a port is the fair wind charter in Hong Kong, the Singapore and schemes in Seattle, the Houston, and Vancouver to mention few [32].

Further, to achieve a significant shift towards a low-carbon emission in the environment globally, every country must participate in CO_2 mitigation activities of providing alternative and clean energy supplies of industrialized economies and directing developing economies towards a low carbon development path. Thus, on time and accurate CO_2 GHG statistics is significant regarding measuring the achievements of international targets set for monitoring climate change activities and providing information for policy maker as well. The ability of a nation to effectively monitor and renew carbon emission from various industrial sectors is vital in the conversation in national and international GHG control [32].

The Paris agreement on international action beyond 2020 adopted in 2015, endorsed that all countries are mandated to participate in mitigation activities in both developed and developing countries. Thus, since the adoption of the agreement, many nations have moved towards implementing their various commitments. For instance, the negotiation of a rule book that contains the rules and regulations for emission accounting and transparency of mitigation action and support is being adopted and implemented by several countries as well. Another climate change agreement previously adopted to aid in the control of carbon emission in the environment is the Kyoto and Cancun which is viewed to be the early commitment to reduce GHG emission set from 2008-2012 [33]. The agreement requires participating nation as a group to reduce their domestic emission rate by approximately 5%.

Consequently, Kyoto was then amended after which 38 countries agreed to take part in the second commitment that will run from 2013 – 2020. Furthermore, by 2007, approximately 80 countries ratified the amended Kyoto protocol. Thus, suggesting that the protocol is targeted at the reduction of emissions from fossil fuel combustion and other sectors such as land use or direct industrial emission [34].

The activity-based approach is another measure in a situation where data is not available a rough estimation of the carbon emission footprint of various transport activities can be calculated using the formula below;

$C0_2$= tonnes transported x average distance travelled x CO_2 emission factor per tonnes-km [34]

It is vital for those involved in calculating emissions to use the correct conversion factors for the different varieties of fuel being used as shown in table 1 below.Fuel type	kg CO_2 /liter	kg CO_2 /kg	Text
Motor Gasoline	2.8		
Diesel Oil	2.9		
Gas oil	2.9		
Liquefied Petroleum Gas (LPG	1.9		
Compressed Natural Gas (CNG)		3.3	
Jet Kerosene		3.5	
Residual Fuel Oil		3.5	
Biogasoline	1.8		
Biodiesel	1.9		

Table 1: Well-to-Wheel fuel emission conversion factors [34]

Furthermore, a transport company record, ERP systems, and manifest of delivery are documents that can be used to generate the enquired data for tonnages moved by road. Consequently, software applications, for instance, the MapPoint and the Autoroute can be used regarding lists of customer location to approximate road distance as well. For the railways, generating the data for distance can be an issue of concern. However, the EcoTransit online environment assessment tool is widely used to generate data in the intermodal transport system. This so because shippers most often do not know the route used or distance split embarked among the various intermodal transport modes [32].

IV. CONCLUSION

From the literature review, the descriptive case study and other discussions, the study revealed that, over the past years, policy architects in the transport industry at various levels have continued to promote the effective use of the railway transportation system as a means of reducing CO_2 emission in the environment considering its intermodal transport connectivity from ship to train compared to roads that have a high level of carbon emission. Three of the projections in the literature studies reveal that the growth would need the rail system to serve the entire market for long-distance transportation from the coastal port to the hinterland. Thus, the introduction of Heavy Vehicle fee (HVF) by the Swiss government in the descriptive case study was an essential strategy in the reduction GHG emission in the environment by heavy trucks, and if replicated in African, it will be of significant benefit. Other measures to reduce $C0_2$ in the environment from transport activities were discussed and suggestion such as the use of shore power facilities, the use of alternative fuel and energy, the monitoring, documentation, and calculation of $C0_2$ emission using the correct emission factors were discussed with a recommendation of computer software that can be applied mentioned. The participation of countries in $C0_2$ mitigation activities as recommended by the Paris agreement and the Kyoto and Cancun agreements respectively were discussed. The study also showed in the discussion of the intermodal transport system that the lack of space in coastal ports is a significant challenge for containerized shipments that leads to port congestion. It could be suggested, therefore, that the implementation of the railway system and the integration of the inland container depot in Africa can be an essential strategy to reducing CO_2 emission

in the environment, reduce port congestion, facilitate cargos movement and reduce transport cost as well.

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