Trans-Regional Railway Corridor and Its Implication on Urbanization

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Article

Trans-Regional Railway Corridor and Its Implication on Urbanization

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Abstract: Recently, the government of Ethiopia has been engaged in modernizing the trans-regional Ethio-Djibouti railway infrastructure. This railway corridor has been serving as the main get way for the landlocked Ethiopia to the port. Scholars argued on the economic importance of this railway corridor, with seldom attention of its impact on linear urban formation and development. This article creates an insight about the implication of the Ethio-Djibouti railway corridor by exploring the question: what kinds of urban form and morphological changes evolved due to the Ethi-Djibouti railway corridor? To examine the impact of this railway corridor, qualitative research method and case study were applied. The article points out that, the railway corridor conceived different kinds of linear urban centers ranging from small towns to intermediate cities around stations. The identified four (Bishoftu, Mojo, Adama, and Dire Dawa) intermediate cities attracts industries, and logistic centers. Those industries that are established in the intermediate cities, existed in a form of special economic zones, which results labour migration from rural and nearby small urban centers that caused rural-urban continuum of ribbon settlement; strengthen trade gate way for the landlocked Ethiopia that caused trans-regional integration.

Keywords: Industrialization; intermediate cities; urbanization; railway station; railway corridor; regional integration

1. Introduction

Urban development is highly path-dependent usually, it evolved on river banks, coastal lines, and terrestrial transportation lines [1, 2]. Transport infrastructure could affect travel time and cost interaction. The provision and improvement of transport infrastructure can give rise to growth in productivity through the reinforcement of agglomeration of people and resource benefits [3]. The travel time-cost interaction has also an impact on land use with the notion of accessibility and connectivity.

Of the different terrestrial transport infrastructure, railway transport corridor is the prominent one that has a direct impact on land use dynamics and development in urban and regional areas. With the advancement on the railway transport technology, recently it become more preferable than other terrestrial modes of transports due to its: energy efficiency, low greenhouse gas emissions and play an increasingly important role in the conveyance of freight over long distance characters. Apart from these, railway infrastructure has centripetal power that serves as nuclei for accumulation of people and firms for the flourishing of urban centers around stations. This created two major railway corridor-based station development approaches: modernizing the old inner city railway stations or construction of new stations on the periphery of the urban centers.

Stations on the railway line often plays significant role to design sustainability strategies for the corridor in general and urban centers in particular. Modern railway stations often trigger holistic (social, economic and environmental) development within the courtyard and its integration with the urban center [4]. Based on the scale of development impact coverage, there are four major railway station-based development frameworks on the corridor, which are advocated by the academia world

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and policy makers. These are: Node-Place development (NPD), Transit Oriented development (TOD), compact or integrated development (CD/ID) and corridor-oriented development (COD) frameworks [5, 6, 7, 8].

In Ethiopia, modern railway transport was introduced during the reign of Emperor Menelik II (1888 – 1913) [3, 4]. The advent of the railway infrastructure caused for the flourishing of the eastern economic corridor. This railway-corridor development results the flourishing of different levels of urban centers ranging from small towns to intermediate cities; establishment of industrial plants in the vicinity of railway stations; inflow of migrant people from rural to newly flourishing railway station based monocentric urban centers; inter and intra trade linkages among regional states etc.

Although the Ethio-Djibouti railway corridor existed for more than a century and it has indispensable role for urbanization and regional development, it overlooked by researchers and policy makers. however, there are few researches that addresses its historical development and economic benefit of the railway line [4, 5, 6, 7]; but none of them addressed the railway corridor impact on urban and/or regional development. This triggers the researchers to contribute for the academia world about the old railway corridor and its impact on the then time new urban development paradigm of station-based urbanization as well as the current periphery-oriented station development which resulted in firm or industries attraction and rural-urban integration.

Therefore, the purpose of this article is to examine the role of railway infrastructure corridor development for city formation that evolves from monocentric station towns to intermediate cities; industrialization through special economic zone development in a form of industrial parks; and regional integration as urban-rural linkages as well as inter-regional and trans-regional linkages.

2. Material and Methods

2.1. Description of the Study Area

Ethiopia is a least developed landlocked sovereign country that lays in the Horn of Africa neighbored with Eretria in the north, Djibouti in the northeast, Somalia in the east and south, Kenya in the south, South Sudan in the west and Sudan in the north-west. The total land mass of Ethiopia is 1.14 million Sq. Km. With a population of greater than 126 million, Ethiopia is the second most populated nation in Africa next to Nigeria [8]. The existing functional railway corridor being examined is located in the eastern direction of Ethiopia. The eastern railway corridor stretched from the central part of Ethiopia to the port of Djibouti.

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Figure 1. The Old and New Ethio-Djibouti Railway Line; Source:[9]

This article also addressed urban centers that evolved from monocentric station based linear city to secondary or intermediate cities as well as industrial parks along with these railway corridors.

2.2. Method

The article mainly employed exploratory research method to search the literature and talk with experts on the historical development of the railway corridor development and its role for urbanization, industrialization and regional integration [10]. To gather primary data about old and new railway line development opensource satellite images, field observation, and key informant interview were conducted; and prefeasibility study of the new standard gauge railway infrastructure and other related legal documents were reviewed. Data from the field were collected to assess the morphological traits of railway stations.

Secondary data were also used to support the primary data and describe the railway corridor development and its urban and regional impacts in the study area. The study mainly focused on the description of the state of affairs as it exists in the past and at present as well as the prospect impact of the railway corridor on urbanization, industrialization and regional integration. [11].

This article critically analyzed data obtained from CSA, scholar articles and reports focused on Ethio-Djibouti railway corridor. The analysis of the effects that the railway corridor have had on urbanization which creates industrialization and rural urban linkage is largely based on qualitative research.

Becoming reliance on qualitative research, the outbreaks of COVID-19 and continuous internal instability, might be considered as major limitations. On the other hand, the new standard gauge railway line was officially started operation very recently, i.e., 2018; making it difficult to find

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comprehensive data from responsible government organs like ERC. This limitation was addresses through analyzing and comparing variety of works written by scholars and journalists in order minimize some level of possible bias.

The other limitation of this article emanates from the applicability of the analysis to another similar trans regional economic railway corridor that will be developed in Ethiopia such as the Awash-Kombolcha railway corridor. Hence, to avoid the issue of generalization the article argues the need to follow case-by case examination. Therefore, this article employed case study as an adequate research method for scrutinizing the corridor's impact on urbanization, industrialization and regional integration in general as well as station based intermediate cities in particular.

2.3. Case Study

The article specifically examines intermediate urban centers from the vantage points of railway corridor impacts on urban dynamics, industrialization, and regional integration. In order to select intermediate cities, the article followed two stage analysis. First the article reviews the existing literature and legal documents on the notion and nature of intermediate city. Then selection criteria were set to determine railway station based intermediate cities using enforceable legal documents, MoUI reports and CSS data.

A. The Notion and Nature of Intermediate City

The word 'intermediary' was first introduced in the academia world in the mid-1980s, which resembles medium-size city' [15]. There are many different viewpoints about intermediate city. Some countries interchangeably used intermediate or middle-size city and secondary city, as a category of intermediate city [16]. UCLG, define 'intermediary urban center' using the elements of specific demographic size of more than 50,000 and the functions they perform, such as: their role in mediating flows of goods, information, innovations and administration, etc. between rural and urban areas, within the respective areas of influence and with respect to other urban centers or regions, which may be close to them or more distant [15].

Ethiopia used the term intermediate city and secondary city interchangeably, since 2005 with the approval of national urban policy [16]. The MoUI, considered urban agglomerations having greater than 20,000 inhabitants as intermediate or secondary or major city [17].

B. Criteria Setting and Sample Selection

In order to select intermediate cities, this article employed population size and function perform as administration and economic hub. Accordingly, those urban centers with a population of greater than 20,000 inhabitants (taking the national standard), and functionally served as regional capital and/or logistic hub/industrial hub considered as intermediate cities.

Based on the 2022 year CSS population projection seven urban centers feats the minimum threshold of intermediate city (MTIC) requirement i.e., > 20,000 inhabitants [17]; namely: Bishoftu/Debre Zeyit, Mojo, Adama/Nazret, Welenchiti, Awash Sebat Kilo, Mieso and Dire Dawa.

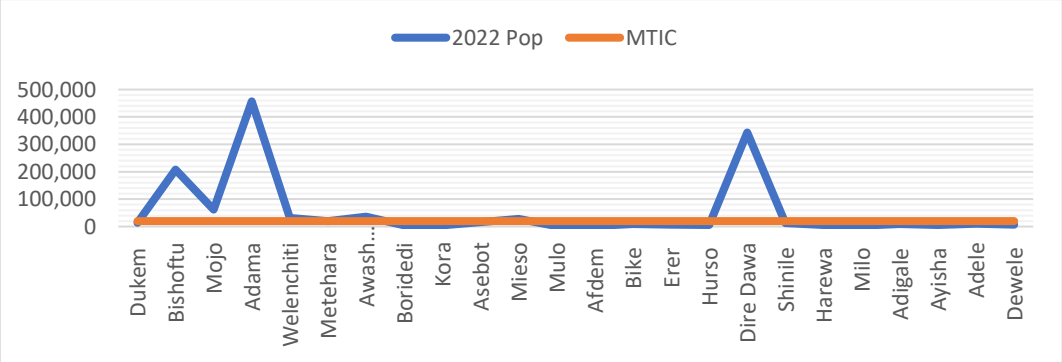

Figure 2. Population Size for Station Based Urban Centers on the Ethio-Djibouti Railway Corridor.Source: CSS, 2022; Computed by Authors.

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With regards to fanctionality administration status, avilability of logistic hub and industrial park were used. In Ethioia administrative hierarchy starts at the top Federal capital followed by regional capital then zonal capital and woreda capital. Dire Dawa is charter based self administrative city. Accordingly, Dire Dawa Bishoftu and Adama fulfiled all the three criteria. Mojo also fulfiled the two criteria of having logstic hub and industrial park. Therefore, this article selected Dire Dawa, Bishoftu, Adama and Mojo as case study.

Table 1. List of Potential Intermediate Cities on the Ethio-Djibouti Railway Corridor.

Name of Intermediate city	Administration status	Avilability of logistic hub	Avilability of industrial park
Bishoftu	Zonal capital	√	√
Mojo	Woreda capital	√	√
Adama	Zonal capital	√	√
Welenchiti	Woreda capital	×	×
Awash Sebat Killo	Woreda capital	×	×
Mieso	Woreda capital	×	×
Dire Dawa	Federal city	√	√

Source: Computed by Authors; 2023.

3. Literature Review

3.1. Railway Corridor

The word corridor refers to passageway or 'route' or ' 'an area or stretch of land identified by a specific common characteristic or purpose' [18]. Epistemologically, the term 'corridor' derived from Latin word *'currere'* meaning to run [19]. Whebell (1969), explain corridor as 'a linear system of urban places together with the linking surface transport media' [20]. From the physical or spatial planning perspective corridors are bundles of transport and logistics infrastructure that connects two or more urban centers [21].

As one of the major terrestrial infrastructure, railway corridors have significant roles for urbanization, which results in industrialization and rural-urban integration. The railways transports represents an essential aspect of socio-economic urban life and railway transportation systems, comprises of network and nodes or growth poles, have distinct urban and regional functions [19]. The railway transport system has spatial structure of infrastructure corridors and stations. Often, stations serve as nodes for access to transport networks. The provision and improvement of railway transport infrastructure can give rise to growth in productivity through the reinforcement of agglomeration of people and resource benefits [22]. An ideal infrastructure corridor and station design and development with advanced materials will create more sustainable urban and regional environment [19].

3.2. Railway Corridor verses Urban Formation and Urbanization

Corridor oriented urbanization is directly related to linear or ribbon pattern urban form concept. As a planning concept, linear or ribbon urban development was introduced in the late 19th century by the Spanish urban planner known as Soria y Mata (1844-1920) who developed an idea of the Ciudad Lineal, a linear garden city [28, 29]. Following to him planners like Hilberseimer (1955) gives special attention for 'a linear system of urban growth with strong connecting links', through

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producing maps that depicts this fact; and the architectural historian George R. Collins (1960s), theorized the notion of linear oriented urbanization [28]. *"...linear growth is the natural pattern of growth of urban regions. Cities develop along a linear passage called corridor which is usually its artery of transport for people, for goods, and for services: roads, rails, pipes, and wires"* [30]

The linear urbanization is mainly a modernist concept and can be regarded as urban/spatial expression of modernist (Fordist) production, inspired by repetition, mass production, and the development of the train, highway and the assembly line [31].

The technical term 'corridor' was used in urban and regional planning in the late 1950s [28]. Then the corridor development concept become an explicit part of urban and regional spatial planning [32]. Corridor based linear or ribbon urbanization, can be observed as an evolutionary and long-term concept for urban or regional development, taking into consideration technological and locational assets and changes [31]. The corridor urban center, as part of a historical urban pattern- be regarded as spatial expression of postmodern flexible production and decline of spatial fixation [31].

Usually, corridor-oriented urbanization flourished around stations or terminals. At the early stage of urban formation, infrastructure corridor based urban center characterized as monocentric, taking station as the sole growth pole. Through time station based monocentric urban centers developed multiple hubs like administration hub, commercial hub, industrial hub. This makes the urban center to have wider width that transform to multi nodes or growth poles.

3.3. Railway Corridor verses Industrialization

Industrialization is the process of sectoral transformation in which industry is dominated [34]. The transport infrastructure corridor particularly the railway corridor has been an indispensable impact for industrial development and industrialization process. Industrialization is the key to economic development [35]. Modern industrial sectors improve productivity, fosters innovation, and facilitates technology diffusion and other positive spillover effects [35]. Nations used different policy options for the realization of industrialization in their country. The prominent policy options are: import substitution, export-oriented industrialization, special economic zone and agro-industrial parks [35].

Scholars argued that, railway corridors and industrial parks has a direct nexus for the emergence of 'intermediate city' [36]. There are different types of intermediate cities and these can be broadly categorized in to: regional, clustered and corridor intermediate cities [36].

3.4 Railway Corridor verses Regional Integration

Regional integration is a means to "achieve sustained, equitable and inclusive economic growth in least developed countries […] and overcoming their marginalization through their effective integration into the global economy" [38]. It also emphasizes on facilitating development in least-developed countries through improved productive capacity, infrastructure, and trade.

Regional integration is crucial for sustainable and inclusive development [39]. It cannot happen without adequate infrastructure. Due to this regional integration offers opportunities for leveraging urbanization for industrial demand, including across borders. Railway transportation corridor are critical for linking regional cities and zones of industrial production.

For a land-locked country, railway infrastructure is an important component of regional integration. It offers opportunities for further leveraging momentum of cross-border economic linkage and urbanization for industrial demand. Special economic zones, can have a bigger impact if well managed and connected to urban centers.

4. Results and Discussions

4.1. Historical Incites on Railway Corridor Development in Ethiopia

4.1.1. Genesis of Railway Corridor

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In the beginning of the 20th century terrestrial transport was introduced in Ethiopia. Emperor Menelik II is well known in his effort to modernize Ethiopia [23]. Of the different modernization activities, the introduction of the modern communication system was the prominent one. As a communication system, the railway transport with its intrinsic element of the telegram was started construction and installation during the Emperor Menelik II reign period [4]. Unlike other African countries, the concept of railway line construction was conceived by indigenous African leader i.e., the Emperor and followed innovative management strategy using public private partnership (PPP) approach to design, built and administer the railway transport corridor.

The mission to undertake the railway project was given to Ilg on the 11th of February 1893 [4]. Accordingly, Igl with his friend the Frenchman, Leon Chefneux, who had been active in the country since 1882, went to Europe in quest of the necessary capital and to established a company. Then the Imperial Railway Company of Ethiopia or '*Compagnie Imperiale des Chemins de fer d'Ethioie*' was established in 1894. After the necessary preparation, the railway construction started in 1897, with the French standard. This old trans-regional Ethio-Djibouti Railway was a single metric gauge (950mm), with 781 km length that stretched from the Ethiopian capital Addis Ababa to the port of Djibouti. The construction of railway line was accompanied with the installation of telegram and construction of stations. The first commercial service was started from the port of Djibouti to the border town Dewele, Ethiopia in 1901. Then the railway reached Dire Dawa in 1903. After a number of ups and downs the railway line reached Addis Ababa in 1917. This railway corridor had been serving as the main economic corridor for the landlocked Ethiopia until the 1950s, when it began facing competition from road transport and federation of Eritrea with the Assab and Massawa ports. Following to this period the railway corridor become declining from time to time due to lack of maintenance and management.

Then after the independent of Eritrea (1993), particularly after the border conflict of Ethiopia with Eritrea (1998), the government forced to revitalize the old Ethio-Djibouti railway corridor, which deteriorated and partially destroyed due to old age and civil wars. Since then, the government used the port of Djibouti as the main gateway for landlocked Ethiopia. Specifically in 2007, the government of Ethiopia established technical advisory group under the Ministry of Transport to undertake a framework for the revitalization and development of railway corridor. The study emphasized the importance of modernization and expansion of the existing 950m gauge railway to a standard gauge (1,435 mm) line to provide faster access to the Port of Djibouti from inland Ethiopia.

4.1.2. The New Standard Guage Railway Corridor

As the major infrastructure development plan, the national railway lines revitalization and development project is very crucial to meet the infrastructure demand of the country, boosting the national economy and bringing urban development and land use dynamics. For the realization of this railway infrastructure, the country has designed National Railway Network of Ethiopia (NRNE) project and established the Ethiopian Railway Corporation (ERC) to administer it [24, 17, 25] .

As Figure 3 indicates, there are two railway corridors i.e., Sebeta to Dewele and Awash Sebat Kilo to Weldia are completed. Of these, Sebeta to Dewele corridor is operational. This new standard gauge railway line is constructed adjacent to the old railway line. The new railway standard gauge brings considerable advantages for long distance freight transport on reducing travel times, from up to 50 hours down to 10 hours.

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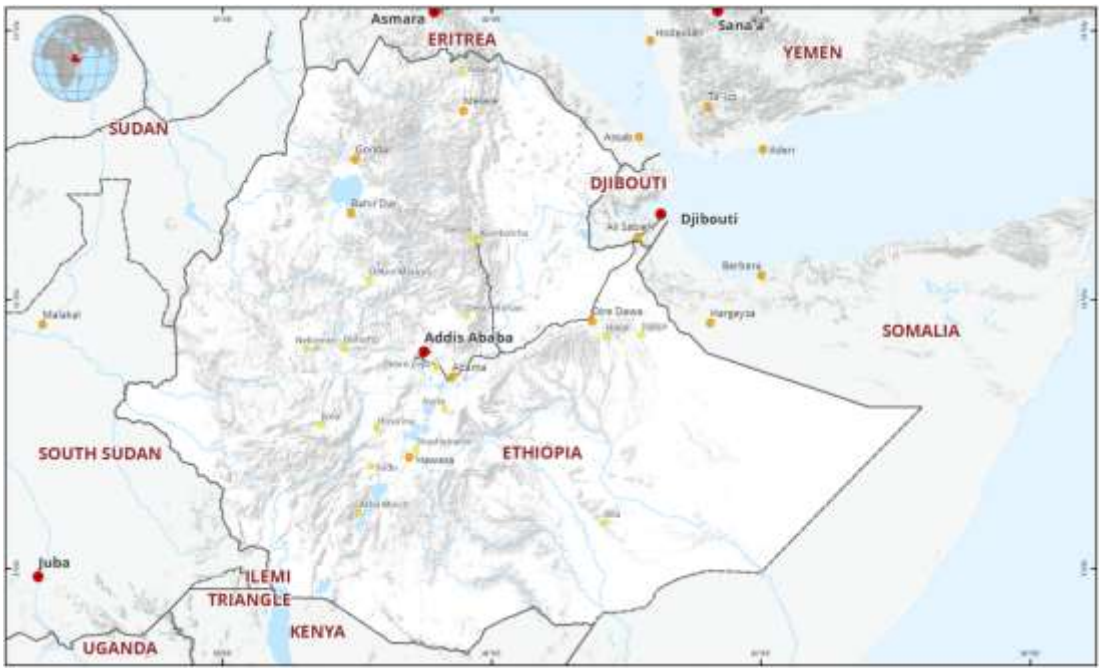

Figure 3. The New Standard Guage Railway Corridors; Source:[26]

The newly operational standard gauge (1,435mm gauge line with 25kv electrification) railway line is the first environmentally friendly cross border railway corridor in Africa. It is part of the Road and Belt Initiative constructed with a total amount of 5.1 billion USD as of the 2011 value. The railway corridor has a total length of 743.44km with Sebeta to Adama 115Km double track and the remaining line is single track one [9]. From the total length of the railway line 645.44 (86.81%) is located in Ethiopia.

The new railway line limits the number of stations into 20. Among these majority 17 (85%) of the stations existed in the Ethiopian Jurisdiction; from these Bishoftu, Mojo, Adama, Methara, Awash Sebat Killo, Meiso and Dire Dawa have stations located in the vicinity of corresponding intermediate cities.

Table 2. The New Standard Gauge Railway Stations on the Ethio-Djibouti Ralway Corridor.

Station section		Distance in Km	Distance Between Major Fright Stations		
From	To		From	To	KM
Sebeta	Lebu	13.322	Sebeta	Indode	31.631
Lebu	Indode	18.309			
Indode	Bishoftu	37.61	Indode	Mojo	58.263
Bishoftu	Mdjo	20.653			
Modjo	Adama	23.361	Mojo	Adama	23.361
Adama	Feto	41.171			
Feto	Methara	63.122	Adama	Awash	157.15
Methara	Awash Sebat Killo	29.496			
Awash Sebat Killo	Sirba Kunkur	43.4			
Sirba Kunkur	Mieso	48.28	Awash	Dire Dawa	191.8
Mieso	Bike	35.56			
Bike	Dire Dawa	64.56			
Dire Dawa	Arawa	53.068			
Arawa	Adigala	61.778			

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Station section		Distance in Km	Distance Between Major Fright Stations		
From	To		From	To	KM
Adigala	Aysha	50.95			
Aysha	Dawele	40.8			
Dawele	Alishabeh	20			
Alishabeh	Holhol	46			
Holhol	Negad	32			
Total		**743.44**			

Source: [27], 2022; Computed by Authors.

4.2 The Impact of the Railway Corridor in Ethiopia

In the beginning of 20th century modern type of railway transport was introduced in Ethiopia. The advent of these modern terrestrial railway infrastructure caused for the flourishing of the eastern economic corridor. This ester railway corridor was one of the major causes for the flourishing of urban centers that evolved on the major morphological tissues of railway line and stations.

This single gauge (950mm) railway had more than 34 stations and the number of railway stations varies from time to time depending on the advancement in the railway locomotives: steam engines, diesel engines and electric-power engines.

Initially, these stations courtyards had a few buildings that served for providing limited railway service-related functions such as ticket selling, passengers waiting, administration, residential for staff, and warehouse.

Those stations which had a residential house in the courtyard attracted different kinds of urban service providers and traders to live a sedentary life in the vicinity of stations. Then station areas gradually evolved into the urban village and urban centers. The number of urban centers reached more than 25 of which Kabaki-beseka and Melka Jebdu were engulfed by Addis Ababa and Dire Dawa respectively. All station-based urban centers were evolved organically, except Dire Dawa.

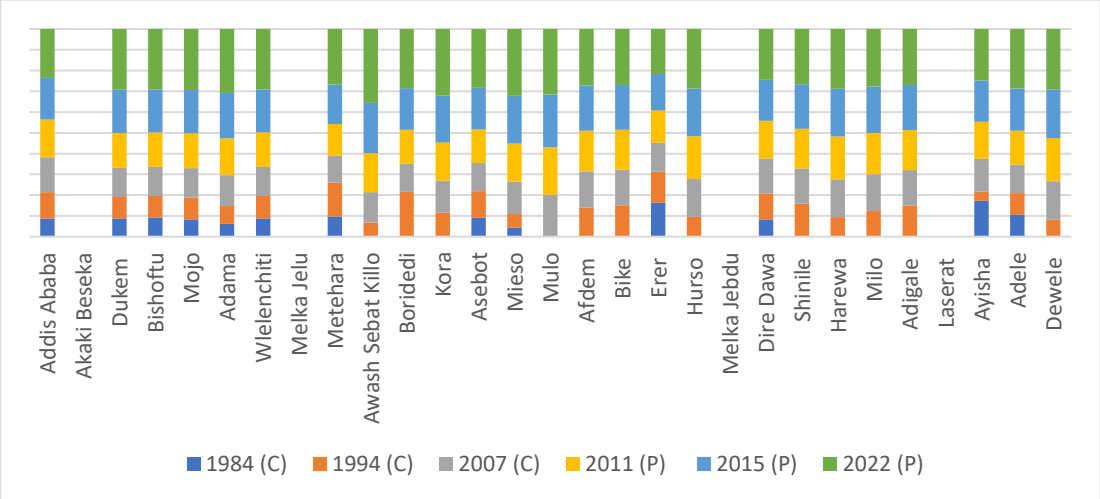

Figure 4. Population Size of Ethio-Djibouti Railway Corridor based urban centers;

Source: Computed by Authors from CSA/CSS 1984, 1994, 2007, 2011, 2015 and 2022 reports

NB: C- Census and P – Projected population

In this sub section, the article examines the population dynamics (population size and growth rate in a time horizon) and Morphological traits (station location and station yard function) of station based urban centers with special emphasis on station based intermediate cities.

4.2.1. Population Dynamics

A. Population Size

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During the early period of modern Ethiopia, railway corridor specifically stations played a significant role in the formation of urban centers and introducing new dimensions of urbanization. The old railway corridor causes for the flourishing of more than 29 urban centers. Of these Akaki Beseka and Melka J All these railway station-based urban centers were flourished before the Italian aggression (1935-1940). Although these urban center has greater than 100 years old, only 7 station-based urban centers have greater than 20,000 inhabitants and only four reached the status of intermediate city.

To compute population dynamics of station based intermediate cities, the article used the 1984, 1994 and 2007 census results and the 2011, 2015 and 2022 Central Statistical Service (CSS) projection. As stated above the year 2007, 2011 and 2015 had some important events for the railway corridor.

As Figure 5 indicates, during the 1984 census, with the exception of Mojo all intermediate cities had greater than 50,000 inhabitants. In the 2022 CSS projection Adama shown significant population growth, followed by Dire Dawa and Bishoftu.

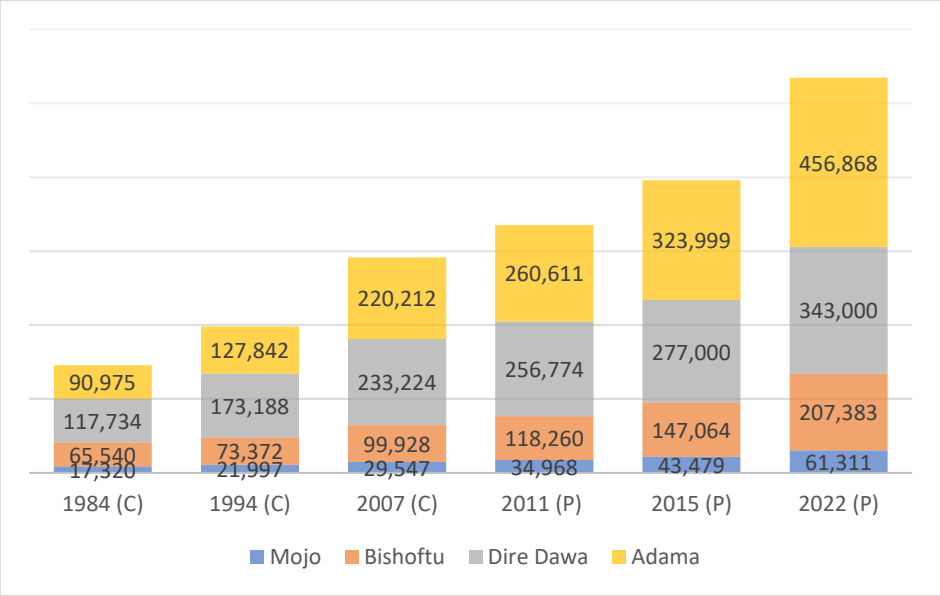

Figure 5. Population Size of Ethio-Djibouti Railway Corridor based Intermediate Cities. Source: Computed by Authors from CSA/CSS 1984, 1994, 2007, 2011, 2015 and 2022 reports.

B. Population Growth

With regards to the population growth rate, initially between the two census period of 1884 – 1994, Dire Dawa (2.67) and Bishoftu/Debre Zeit (1.19) had shown the largest and the least growth rates respectively. With the exception of Dire Dawa all the other intermediate cities had shown significant growth rate starting from 2007 – 2012 period. The overall growth rate (1984-2022) of railway corridor based intermediate cities indicates that only all demonstrates above the national urban average growth rate i.e., 3.7 [33]. However, the Dire Dawa growth rate is almost by half lower than the other three intermediate cities. (See Figure 5)

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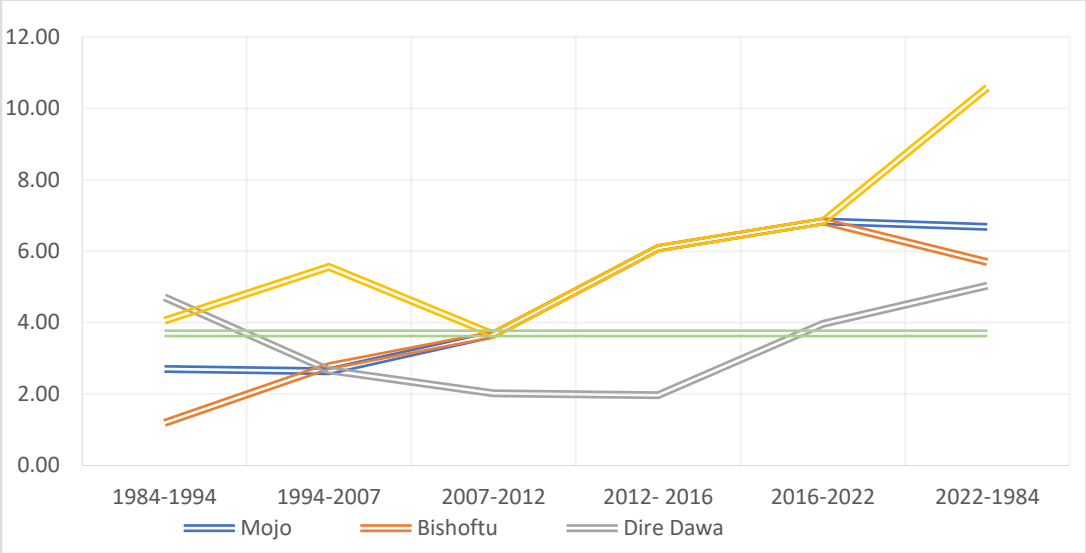

Figure 5. Population Growth Rate for Station Based Intermediate Cities**.**

Source: Computed by Authors from CSA/CSS 1984, 1994, 2007, 2011, 2015 and 2022 reports.

4.2.2. Morphological traits of Station in the Intermediate Cities

Railway station is an area which regularly provides railway facilities or stop to load or unload passengers or freights or both. It is generally consists of at least one track side platform and a station building, which provides auxiliary services like ticket sales, waiting rooms, baggage/freight services.

Station might be existed at the ground level, underground and elevated level. All the Ethio-Djibouti railway station are located at the ground level. There are different determinant factors for the selection of convenient sites for railway location the following are the prominent ones:

i. Affordability: the distance between station and localities should be affordable for users;
ii. Connectivity: the station should be linked with the nearby areas with proper road;
iii. Safety: the existence of fairly level ground
iv. Availability: there should be sufficient land for future expansion and development

Taking these into account in the following pages the article analyzed station location, types of station and station yards, which has a direct impact on station based urban centers morphology.

A. Station Location

In this part station location is analyzed from the railway engineering, nature of locomotives, and city perspective point of views.

✧ From Railway Engineering Perspective

From the engineering perspective stations location can be categorized in to three taking the position of stations in line with the railway line infrastructure. There are:

i. Way-side station: is located on running lines. This allows faster train to overtake a slower train. For this loop line and siding are provided.
ii. Junction station: railway lines from three or more directions meet the junction has minimum of one main line and other branch line.
iii. Terminal station: refers to the dead end of incoming track or the station at which railway line ends or terminate.

From these station types all the old railway stions were way-side station type. Similarly, all the stations constructed on the new standard gauge railway line way-side station types are exhibited. Therefore, all the intermediate cities that are located on the trans-regional Ethio-Djibouti have way-side station type.

✧ From the Nature of Locomotives

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The number of railway stations varies from time to time depending on the advancement in the railway locomotives: steam engines, diesel engines and electric-power engines. At the initial stages of the railway transport service all the locomotives were steam engines; because of this majority of the stations were constructed near to water bodies (river banks or lacks), which had cooler purpose to the steam engines. With the advent of diesel engine locomotive, the number of stations decreased significantly. Based on this the old railway stations can be grouped in two: stations near to water body and stations without water body. From the four intermediate cities Bishoftu, Mojo, and Dire Dawa railway stations were constructed near to water body.

✧ From the City Perspective

The development of new standard gauge railway corridor reduced the number of stations 34 to 20. Among these majority of 17 (89.47%) stations exist in the Ethiopian Jurisdiction. As stated above the old railway stations served as a nucleus for the formation of urban centers. However, the new standard gauge railway stations used a peripheral approach . The functional stations of Mojo, Bishoftu, Adama, and Dire Dawa stations are located in the vicinity of intermediate cities with the ground distance from the old railway of 2.3km, 3.74km, 5.78km and 11.77km respectively. .

B. Station Yards

Station yard is a place on the track where train stops for clearing passengers and goods traffic. In general station yards can be categorized as: passenger bogie, goods/freight, locomotive and marshalling yards.

On the old trans-regional Ethio-Djibouti corridor station based intermediate cities all station were used for both passenger and freight services. The station of Dire Dawa were also served as locomotive yards in which all the facilities of cooling, watering, repairing, oiling, cleaning etc. services were provided.

There were also stations that are located between intermediate cities. These stations known as dry station or *'derek tabiya' in local language*, which were served as mobile maintenance services center. For instance, Dalota, Lemlem, Dankaka, Tedie Mariam, Soleqie, Feto, Borchota, Haro Arba, Sabu Ber, Legebenti, Eilala Sela, Awash Eisht were dry stations located between Bishoftu and Dire Dawa.

Currently there is a functional standard gauge railway line, on this corridor there are stations constructed to provide passenger or freight or both services. From the four intermediate cities only Bishoftu station has been providing passenger services; the rest providing both passenger and freight services. .

4.2.3. Industrialization

In Ethiopia the origin of modern industrialization dated back to the early twenty-first century with the advent of the old Ethio-Djibouti railway corridor. This corridor plays an indispensable role for agglomeration of industries and trade centers such as Akaki, Dukem, Bishoftu (Debre Zeit), Adama (Nazret), Mojo, Metehara, Awash and Dire Dawa.

Recently the Ethiopia Government has been constructing industrial parks in different parts of the country. The government followed the SEZ policy approach with the intention of maximizing social and economic development through job creation, export generation, import substitution and know-how and technology transfer from investors. The rate and scale of industrial parks development by the Federal Government, regional states, and private developers has had an affirmative effect on the urbanization processes [37]. These industrial parks have, in turn, intensified the growth and development of already-existing urban centers, or have created cluster cities [37].

Currently, there are a total of 25 industrial parks (IP) that are operational in Ethiopia, of which 17 are government-owned (14 by the Federal government and 3 by the regional states) and 7 are privately-owned. The Chines owned Eastern IP covering 400 hectares was inaugurated in 2010 as the first privately-developed IP. The total area allotted for IP is 20,830.47ha, form this IP located in intermediate cities covers 7,595ha or 36.46%.

Table 3. Industrial Parks Located in the Intermediate Cities along the Railway Corridor **.**

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Ownership	Name of IP	Acquired Land (in ha)	Urban center	Specialization	Status
Government	Adama IP	2000	Adama	Assembling, food processing & Garment	Operational
	Dire Dawa IP	4186	Dire Dawa	Assembling, food processing & Garment	Operational
	Bishoftu IP	189	Oromia		Planning stage
	Mojo Leather Industry	290	Oromia	Leather	Planning stage
	Sub-Total	**6,665**			
Private	Eastern Industrial Zone	500	Oromia	Various	Operational
	Mojo George Shoe	50	Oromia	Leather	Operational
	CCECC	380	Dire Dawa	Various	Under Construction
	Sub-Total	**930**			
	Grand Total	**7,595**			

Source: Authors, 2023.

Similar to the railway line and stations, all the industrial parks have been developed on agricultural land. Which have an adverse impact on agricultural production and socio-economic impact on the agricultural communities living in the fringe areas of intermediate cities.

4.2.4. Regional Integration

There is no consensus on the exact definition of regional integration. However, there is an agreement that regional integration has cross-border and multi-dimensional nature. It promotes socio-economic development by expanding markets and trade, enhancing cooperation, spreading risks, and fostering socio-cultural cooperation and regional stability benefits.

Regional integration cannot proceed without regional transport and infrastructure. It is indispensable for factor connectivity, investment flows and value creation. Connectivity is the chain link that characterizes the economy of the 21st century, which is manifested in connecting landlocked countries to ports.

As a landlocked country the Ethio-Djibouti railway corridor plays an indispensable role creating get way to port for trade, better physical connection with neighboring country, free movement of people from area of no job to labour is in high demand etc.

A) Rural-Urban Continuum

In the rural-urban dichotomy, there are areas neither rural nor urban features that are located in the immediate vicinity of cities. Different scholars examine these urban fringe areas as: peri-urban, suburban, rurban, rural-urban continuum, composite settlements, gragara, and desakota settlements, depending on the region's size, scale, and settings [40]. In the fast urbanized world, fringe development is inevitable; however, there is seldom recognition and definition for such kinds of area [40].

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In the trans-regional Ethio-Djibouti railway corridor station based intermediate cities, there is urban expansion or fringe development phenomena. This fringe development phenomena have a rural-urban continuum (RUC) feature. RUC refers to the merger of rural and urban areas, thereby eradicating the assumption of a clear-cut distinction between the two dichotomy areas.

Based on the morphological settlements pattern urban fringes can be broadly categorized as: Polycentric urban centers formed by multiple monocentric cities; Ribbon Development; and Desakota Settlements [40].

In Ethiopia, ribbon development urban morphology phenomena existed on the north-west parts of Bishoftu, and Dire Dawa and Southern parts of Mojo, and Adama intermediate cities. Previous agricultural land of the fringes Bishoftu, Mojo, Adama, and Dire Dawa intermediate cities gradually converted to urban mainly due to industrial parks development.

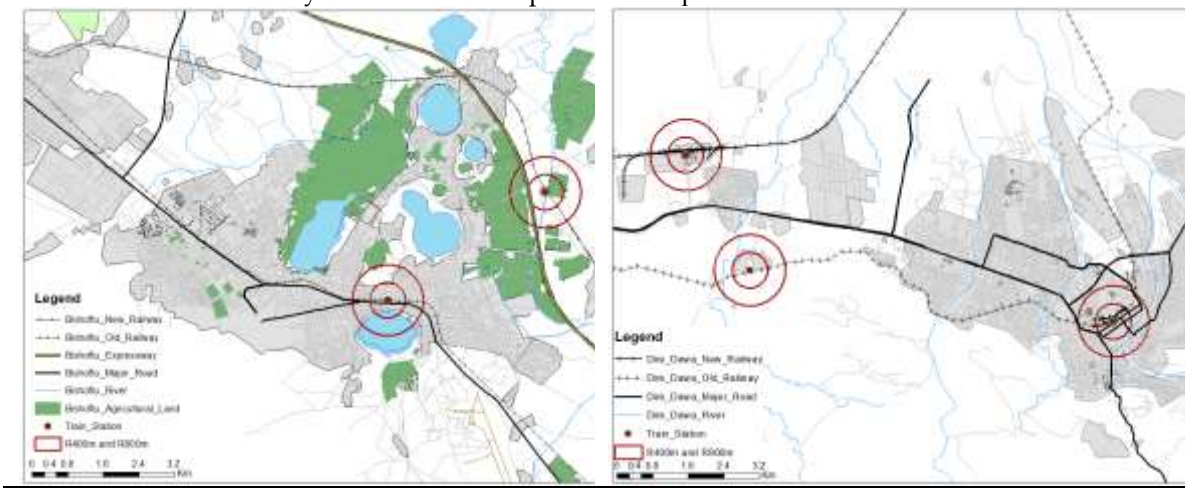

Figure 6. Bishoftu and Dire Dawa Railway Stations.

Figure 7. Mojo and Adama Railway Stations.

In a few intermediate cities polycentric urban centers formed by multiple monocentric cities. For instance, in the northern part of Bishoftu there is monocentric city namely Dukem. This makes RUC morphological settlement pattern in the area. This RUC phenomena stretches to Addis Ababa. For that matter both the old and new railway stations as well as industrial parks were constructed on the agricultural land. An interview with the ERC affirmed that each station of the new standard gauge railway has approximately 300 hectares of land, principally farmland.

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Figure 8. Rural-Urban continuum on the south eastern direction of Addis Ababa.

The other example exhibited in Dire Dawa, as the figure depict there was a monocentric station based urban center i.e., Melka Jebdu located in the north-western direction of Dire Dawa. This nearby station town become part of Dire Dawa city administration. This makes the intermediate city to have more than one development hubs and become polycentric city.

Figure 9. a & b: Google Image of 1985 and 2021 of Melka Jebdu and Dire Dawa Urban Growth.

B) Economic/Trade Integration

Regional integration is linked to competitiveness and innovation through knowledge sharing and network connections. The existing functional standard gauge railway corridor has a trans regional nature that connect land locked Ethiopia to the international trade through the port of Djibouti. This corridor has the highest share (90%) of the international trade.

As table 8 indicates the performance of Ethio-Djibouti railway company decreased from time to time. Specifically, after 2011 with the government policy direction of modernizing the railway transport system, its performance become ceased.

Table 4. The Ethio-Djibouti Old Railway Performance.

	Year

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Revenue and Transport Service		2000	2002	2004	2006	2008	2010	2012	2014
Revenue ('000)	Passenger	13,010	18,400	5,218	6,000	2,450	2,300	NA	5,500
	Frights	50,250	37,800	37,042	27,400	7,050	5,700	NA	NA
Total		63,260	56,200	42,260	33,400	9,500	8,000		
Transportation Service	Passengers Travel in Km (Million)	145	254	40	24	26	5		15
	Freight carried ('000 Tons)	285.3	95	204.3	123	76	2		

Source: CSA 2000-2014.

The new standard gauge trans-regional Ethio-Djibouti railway corridor served for more than 500,000 metric tons cargo and generating ETB 2.5 billion revenue in the past five years. According to the Ethiopia-Djibouti Railway Company, the railway corridor has 11.2% to 15% contribution to the East African country's overall export and import trade.

Figure 10 depicts that the new standard gauge railway corridor starts operation in 205/16. However, the corridor officially started commercial service in January 2018. The Corridor is jointly owned by the two sovereign states of Ethiopia and Djibouti. The railway company assign a Chinese Consortium to manage the corridor through a management contract.

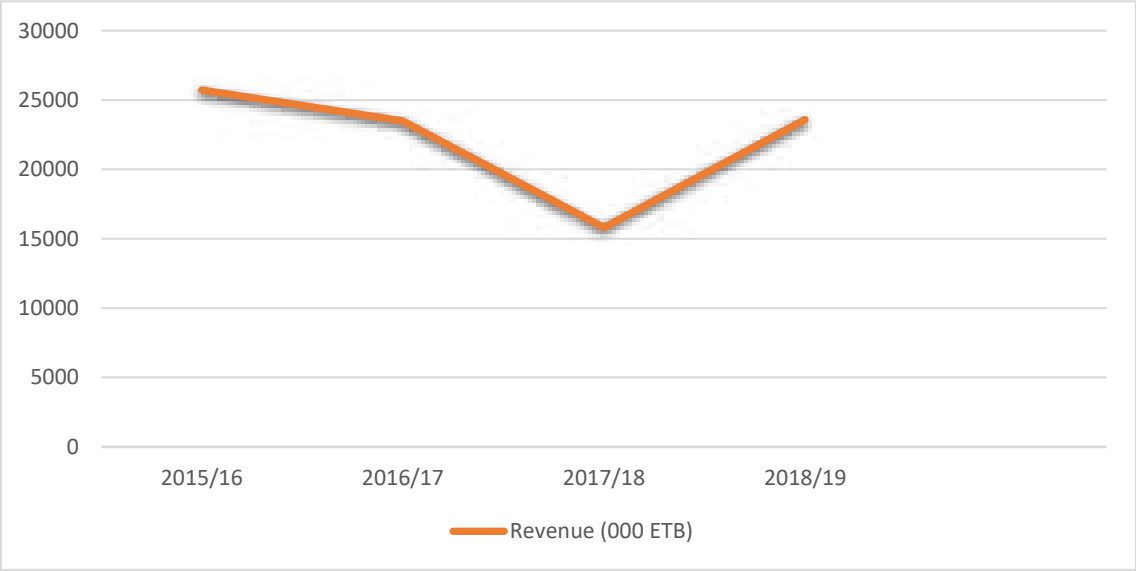

Figure 10. Revenue performance of the New Standard Gauge Ethio-Djibouti Railway Corridor**.**

As the ERC official indicates, initially the new standard gauge railway corridor was designed to operate with an average speed of 80km/hr with a freight tariff of 0.046 per ton/km and 0.023 per ton/km for import and export respectively. Compared to the road corridor, trucks usually cover 903Km length road that stretches from Addis Ababa to the port of Djibouti with the average speed of 60km/hr with a tariff of 0.047USD/ton/km. Due to transportation speed/time, safety, and price the modal share of the railway transport shows 80% to 85% coverage than the truck transport system. (See Figure 11)

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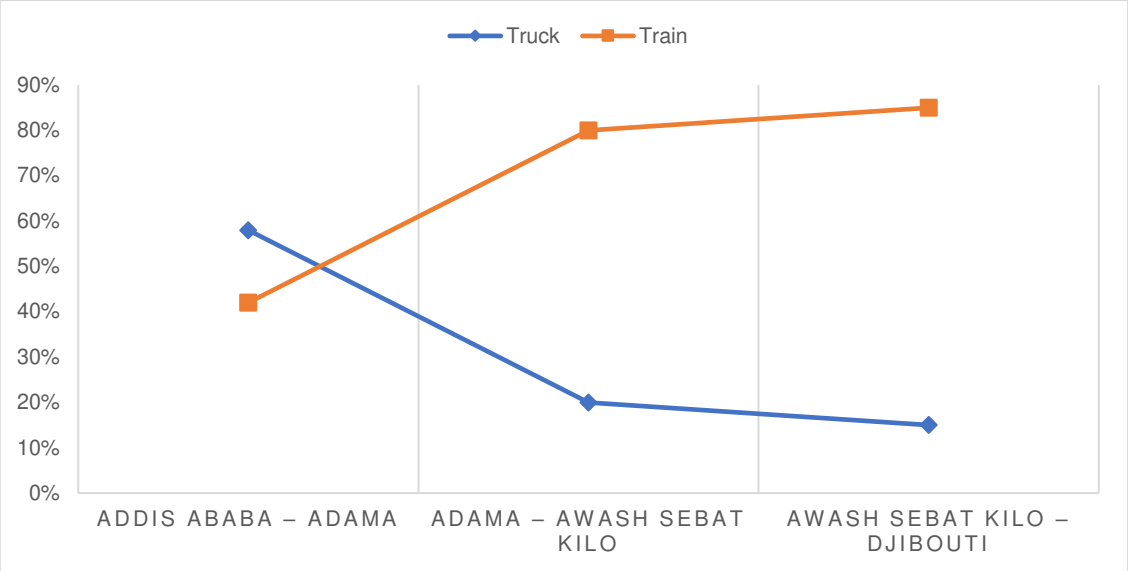

Figure 11. Modal Share of Truck and Train On the Eastern Economic Corridor.

C) Inter-Regional Integration

Taking the current state structure, both the old and new standard gauge railway lines pass through four regional states and two city administrations. Namely: Oromia, Amhara, Afar and Somali regional States, and Addis Ababa and Dire Dawa City Administrations. (See Figure 12)

From the intermediate cities' perspective, all except Dire Dawa are located in Oromia regional state and they are located within 100km radius from the metropolitan city of Addis Ababa.

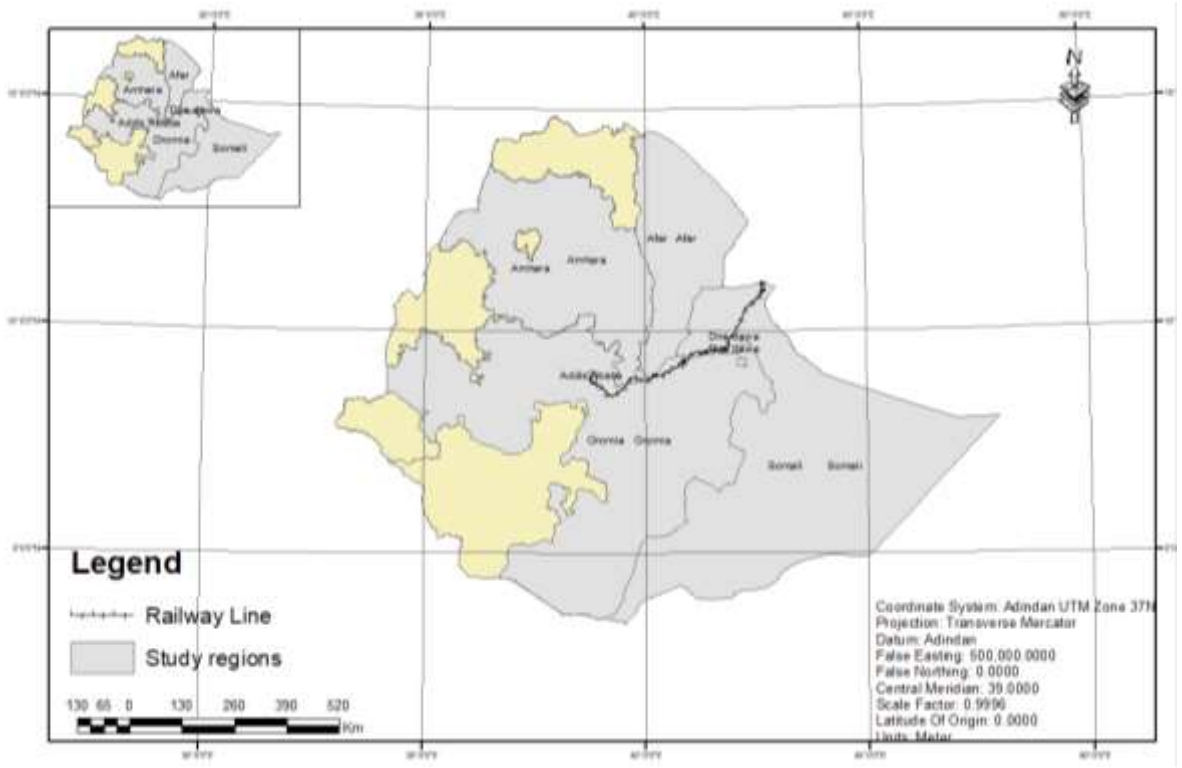

Figure 12. The Eastern Trans-Regional Railway Corridor.

5. Measures to Optimize the Positives Impacts of Railway Corridor

In the academia world, there are different regional development theoretical paradigms; of which functional and territorial integration development approaches are the two dominant ones [41]. The former used top-down development approach, which aims at efficiency and modernization using principles, means and practice of national economic planning, free trade, entrepreneurship and innovations as the driving forces for industrialization, comparative advantage principle and central government intervention [41]. Often the functionalist employed growth center and rural service center strategies for regional development planning [41]. On the other hand, territorialism followed 'bottom up' development approach, in which a change of development should based on economic criteria, competitive behavior, external motivation and large-scale redistributive mechanisms to a new model of development incorporating broader societal goals, collaborative behaviour and endogenous motivation [41].

As Ethiopia followed Federal state structure the power to develop, administer and regulate railway lines linking two or more regional states is given to the Federal government [42]. As the railway infrastructure is one of the enter-regional development, ERC designed, constructed, and administer the new electrified Ethio-Djibouti standard gauge railway line. However, this railway corridor has the following drawback:

a) Inadequate normative farmwork which makes institutional linkage to create sound interaction among federal, regional and city administrations; because of this limitation, almost all of the station towns do not have functional and territorial integration with the railway station.
b) Both the old and new stations had/have limited functions most of them were/are providing limited commuter related services like sealing tickets.
c) The old railway stations were constructed in the vicinity of water body without taking into account its potential to become future urban centers.

To overcome these problems and optimize the yield railway corridor benefits for urbanization, industrialization and regional integration the government should follow:

a) Hybrid regional development policy that obtains both functional and territorial integration on the corridor;
b) Sould station development approach preferably Transit Oriented Development (TOD), this will help planners to incorporate the station and its courtyards into urban strategies; they reinforce its role as a mobility hub and public place for people to meet and work.
c) The government should develop regulatory framework that promotes cooperation and collaboration in economic, social and environmental growth dynamics between ERC and station based urban center authorities.
d) Work with the private sector using PPP approach. This will help to preserve old railway station buildings as a historical building and serve as a gallery for the railway historical events as well as an economically vibrant retail area; and station courtyard with 800m radius will also serve as a mixed-use real estate area.

6. Conclusion

In Ethiopia railway corridor development was started in the beginning of the 20th century. The advent of railway corridor development caused for the flourishing of station based monocentric linear urban centers. Although, this eastern railway infrastructure-based railway corridor has more than 34 railway stations. Although, the railway corridor served for more than 100 years only four urban centers reached the statues of intermediate cities and these cities are evolved from monocentric to polycentric urban centers.

Morphologically, both the old and new standard gauge railway corridor based stations are located at the ground level, using 'way-side' station approach. Since the nature of locomotives were steam engines; all intermediate cities stations were constructed near to water bodies. The old railway

stations served as a nucleus for the formation of urban centers. However, the new standard gauge railway stations used a peripheral approach, which located far from the centers or old railway stations that ranges from 2.3 km (Mojo) to 11 km (Dire Dawa).

The advent of the old railway corridor also plays an indispensable role for clustering of industries and trade centers, and the new railway corridor also attracts SEZ in the form of IPs. The railway corridor demonstrated RUC, specifically the ribbon development and polycentric urban centers formed by multiple monocentric cities.

From the regional integration vantage point, the railway corridor passes through Oromia, Amhara, Afar and Somali regional States, and Addis Ababa and Dire Dawa City Administrations. Of this majority (3 or 75%) of the intermediate cities are located in Oromia regional state and located in the vicinity of the metropolitan city i.e., Addis Ababa, within 100km radius.

The government followed functional integration, which used top-down railway corridor development approach. This makes lacuna on normative farmwork and institutional linkages to create sound integration among federal, regional and city administrations. The stations provide limited functions and the old railway stations were constructed without considering future potential of becoming urban center. To overcome these problems and maximize the benefits of corridor for urbanization, the government should follow hybrid regional development policy; sound station development approach mainly TOD; promulgate regulatory framework that regulate cooperation and collaboration among main stakeholders; and work with the private sector through PPP to make the station yards economically vibrant retail area.

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