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A Suggested Business Model Development Strategy for the Ethiopia Transport Sector: Public Private Partnership (PPP)-based Climate Technology Center and Network (CTCN) Technical Assistance (TA) and Official Development Assistance (ODA)

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ABSTRACT

This study suggests a strategy for developing a business model by analyzing the current situation and deriving lessons learned from existing best practices. The results of a literature survey suggest that the current situation in the Ethiopian transport sector may result in the city of Addis Ababa becoming vulnerable to climate change and the failure of the existing railway business. The railway business could generate added value, but the absence of a master plan hinders the revitalization of railway infrastructure subsidiary facilities, and the predicted risk of falling passenger demand has burdened business stakeholders. In large infrastructure projects such as the railway business, such burdens can be reduced through joint financing, and even if the achievement of a stable profit model fails due to poor forecasting during the creation of the business model, business sustainability can be increased through joint risk management. Therefore, in this study, for climate change response business we suggest to utilize the CTCN TA that can be used for master plan, capacity building, and connect business ODA through large-scale investment in financial resource linkages, as well as business risk distribution. We propose a PPP structure that enhances business sustainability.

Key words: *Climate Technology Center & Network, Technology Assistance, Official Development Assistance, Public-Private Partnership, Ethiopia, Railway Industry*

1. Introduction

Climate change induced by global warming remains a serious issue that should be managed by international cooperation. Following the experience of the defects of the Kyoto Protocol in 2005, strong governance is required that can steer the global climate change regime. The Paris Agreement has been praised as one of the most successful consensus-based accords on the management of international climate change issues. Since the Paris Agreement covers both mitigation and adaptation strategies with various climate change mechanisms such as the Climate Technology Center & Network (CTCN) and the Green Climate Fund (GCF), this accord has a great

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potential to contribute to global mitigation and adaptation to climate change.

The transport sector has undergone significant change due to climate change. According to the International Energy Agency (IEA) (2012), the transport sector has contributed to the highest growth rate of Greenhouse Gas (GHG) emissions. Lah (2015) described the transport sector as difficult to decarbonize. In the transport sector, GHG mitigations through fuel change and electrification cannot be promoted easily since the efficiency of the internal combustion engine is incomparably high. Although public transportation has recently adopted natural gas and electric vehicles are now on the road, the global effort to mitigate climate change in the transport sector should be promoted.

The railway industry has the same problem. Since both domestic and international railways require high value-added and large-scale infrastructure, mitigation by fuel change and entire efficiency improvement through new railway station construction in the railway industry may have tremendous adverse effects on the economy. According to Baker et al., (2009), the electrification and the provision of high-speed railways could be a mitigation solution in the railway sector, but only if the electricity used is produced by clean sources. This implies that mitigation efforts in the transportation and railway industries should develop in line with the energy transition in the generation sector. Accordingly, considering the massive financing required to cover this issue, developing countries alone promote the mitigation business in those industries. Climate change needs to be addressed at a global level and international cooperation must identify solutions.

Ethiopia is an interior country of the African continent. Although the recession has threatened the economy, Ethiopia is the most populous country within Africa and has a large potential in the transport sector since it borders on six countries including Djibouti, Kenya, and the Republic of South Sudan. The accessibility of neighboring countries and trade cost reduction are positive features for developing relevant industry; therefore, thorough investment in railway and road infrastructure has been emphasized (Biau et al., 2008; Faye et al., 2004). Furthermore, given that the Ethiopia-Djibouti railway, which is opened in 2016, has had a tremendously positive impact on the economy (Mohapatra, 2017), the railway industry will enlarge its position in both economic terms and manage climate issues in Ethiopia.

As mentioned above, since the railway industry needs large-scale financing, developing countries may not be able to manage the business domestically. Currently, Ethiopia needs a long-term plan for the railway and transport sector to vitalize the economy and mitigate climate change. CTCN Technology Assistance (TA) can be utilized as seed financing to establish a master plan (MP) for developing countries. In addition, CTCN TA has often been applied to capacity building.

Official development assistance (ODA) can also offer financing linkages. After becoming a member of the Development Assistance Committee of Organization for Economic Cooperation and Development in 2010, South Korea set a plan called “A Strategy to Develop International Development and Cooperation” to manage Official Development Assistance (ODA) funding. Furthermore, it selected 24 countries involved in the Country Partnership Strategy based on this strategy (ODA Korea, 2017). Those 24 countries consist of 11 states from Asia, seven from Africa, four from Central and South America, and two from the Middle East and Commonwealth of Independent States. Moreover, the government of South Korea has demarcated nine funding areas including transportation, health and hygiene, and education (ODA Korea, 2015).

Of these nine areas, transportation is the foundation of city development, which is closely related to the development of other economic and industrial infrastructure and is important to secure sustainable resources. South Korea’s transportation ODA comprised 15.1% of their total budget in 2019, and 13.3% in 2020, which remains bigger than the other areas (Interagency, 2019a, b). However, most projects aim to achieve outcomes in the short term and therefore lead to a lack of connectivity between projects and activities. For example, most of South Korea’s projects in transportation and city

areas concentrate on establishing a MP but are not connected to subsequent projects (Ahn, 2019).

Recently, the possibility of Public-Private-Partnership (PPP) was raised as a new strategy to invite the private sector to invest financially and release financial burdens. In fact, private financing is gradually increasing in international development and cooperation (Oh, 2015). Even though PPP has no clear definition, it shares the public service obligation of governments, with pan-government institutions, international organizations, and the private sector. Moreover, PPP helps maintain stable and long-term resources (Son et al., 2014). On the other hand, the private sector focuses on profit-making (Son et al., 2014; Adetunji, 2011), and neglects ultimate values including anti-poverty measures and environmental improvement in international development cooperation through ODA (SIDA, 2004). As a consequence, new approaches are required that supplement flaws in ODA and strengthen its effectiveness when applying the PPP model.

Ethiopia initiated the operation of the Light Rail Transit (LRT) system in Addis Ababa in September 2015 in order to meet the increased demand for public transportation in Addis Ababa on account of economic growth. It established a MP of Transit Oriented Development based upon the LRT in 2016, but the MP could not be realized because it was difficult to secure the required budget. Unfortunately, the failure of funding cannot satisfy the traffic demand and thus, Addis Ababa does not handle with severe traffic problems. The Ethiopian government tried to address those problems through GCF, which is the UNFCCC finance mechanism implementation agency. Unfortunately, Ethiopia failed to achieve GCF funding because the project was unable to meet the required organizational standards (GTC, 2019). Therefore, the government requested the assistance of the Climate Technology Center and Network (CTCN), which is the UNFCCC technology mechanism implementation agency (CTCN, 2016).

UNFCCC parties' admitted the failure of the Kyoto Protocol to respond to climate change by differentiating developed from developing countries, and agreed to establish the UNFCCC "finance mechanism" and "technology mechanism" to overcome the drawback in the previous regime (UNFCCC, 2011. para. 117). The technology mechanism consists of the Technology Executive Committee support for policymaking, and the CTCN implementing actual technology transfer and raising its importance (CTCN, 2015). The CTCN provides a TA service between countries to facilitate a climate technology transfer. Unlike the previous Kyoto Protocol, this TA service is based on the needs of developing countries (CTCN, 2018; CTCN, 2015), and thus it increases the probability of implementing the appropriate technologies in developing countries' specific environments and conditions.

The government of Ethiopia submitted a TA request to address traffic problems, and CTCN decided to provide TA by appointing this research team to implement a TA project through an empirical study. The major research findings are that Addis Ababa has faced various problems with public transportation systems; including an imbalance between traffic facilities supply and demand, insufficient transportation planning analyzing the demand for public transportation, and the lack of a traffic management system. These three major problems cause high rates of traffic accidents due to an insufficient capacity to manage the system (Envelops, 2019). Specifically, the first problem is the imbalance between traffic facilities supply and demand. People living in Addis Ababa use transportation such as the LRT, buses, and taxis. However, the existing facilities cannot meet the demand for public transportation, and alternative public transportation like buses and taxis are not used enough to relieve and disperse the high demand. Also, there is no strategic traffic management system (Envelops, 2019). Secondly, the insufficient analysis of demand for public transportation is another problem. This means it is difficult to predict traffic demand accurately and make a plan to accommodate demand. Furthermore, existing transport planning does not consider urban development plans, and non-motorized means of transportation such as walking and bicycles (Envelops, 2019). Thirdly, a traffic management system is required to ease transportation in

the city, and a transportation infrastructure such as walkways, buses, taxis, and stations are not enough. In addition, there is no parking enforcement system or regulation of illegal street stalls. It means that related regulations are not sufficient to handle this problem because it does not run using an efficient Intelligent Transport System (Envelops, 2019).

2. Current Situation of Ethiopian Railway

This section examines the Addis Ababa-Djibouti Railway project as a case study. This project has selected because it is one of the major transport infrastructure projects that China supported financially and technically, to implement railway projects in Ethiopia (Dreher et al., 2017). A thorough review of the project has implications for effective and sustainable ODA.

2.1 Overview of Addis Ababa

The Federal Democratic Republic of Ethiopia (hereinafter referred to as Ethiopia) is the second-most populous country in Africa with a population of 79 million, is experiencing rapid urbanization in the form of physical and social growth (Fenta, 2014). Addis Ababa, the capital of Ethiopia is the diplomatic center of Africa having a crucial role in economic, social, political, and administrative processes (Abreha, 2007). It has the largest urban population in the country of roughly 3.3 million (Central Statistical Agency of Ethiopia, 2015). Most financial and commercial institutions and about 85 percent of manufacturing industries are located in the city (Federal Democratic Republic of Ethiopia, 2007). Moreover, it has an international foothold in several international organizations and is the location of the United Nations Economic Commission for Africa and the African Union (Federal Democratic Republic of Ethiopia, 2007). The increasing population size and physical expansion of Addis Ababa contribute to the mobility of the population, which has led to the demand for public transport. Moreover, social, and economic trips by public transport increase the demand for transport in the city (Fenta, 2014).

2.2 Transportation Issues

Despite its economic and social importance domestically and internationally, Addis Ababa has been struggling with transportation problems, especially the insufficient and poor quality of public transport (Fenta, 2014; Kumar et al., 2012). The major modes of public transportation serving the city are Anbessa bus, Alliance bus, and the Higer midi-bus which have deteriorated over time, and the minibus taxi system (Kumar et al., 2012). This modality of transport can hardly deal with the public's demand for transportation (Kumar et al., 2012). It has resulted in the following consequences: heavy traffic jams during peak periods, low vehicle utilization, the weak implementation of traffic management measures, inadequate facilities for pedestrian and non-motorized transport, poor road safety arrangements, and high accident rates (Kumar et al., 2012). Inefficient personal vehicle and public transportation usage induced by poor transportation systems including railway construction eventually result in a city vulnerable to climate change. This implies that Addis Ababa requires an improved city and urban transportation system to deal with climate change problems.

2.3 Project Overview

To respond to the deficient transport supply in Addis Ababa, the Ethiopia-Djibouti railway was built in 1917. However, the railways were not sustainable since the process of operation and maintenance fell behind due to a shortage of technical capacity (Tovar, 2019; Tadesse, 2006).

In this situation, the construction of the Addis Ababa-Djibouti Railway began in 2011. The railway has a length of roughly 756 kilometers (470 miles), linking the capital of Ethiopia, Addis Ababa with the Port of Doraleh in Djibouti (Tovar, 2019). The total cost of the project was 4.5 billion dollars. China's Export-Import Bank, the China Development Bank, and the Industrial and Commercial Bank of China partially funded the project through loans of nearly 3.4 billion dollars (Dreher et al., 2017). The Ethiopian and Djibouti governments financed the rest of the project and currently own the railway (The Diplomat, 2018). Also, the China Railway Group

(CREC) and the China Civil Engineering Construction Corporation (CCECC) were in charge of project construction, the acquisition of building materials and workers, and the operation and maintenance of the railway (Tovar, 2019).

The railway was expected to connect Ethiopia to the maritime trade routes in the Gulf of Aden and the Red Sea, as the first electrified cross-border railway in Africa (Tovar, 2019). Thus, China's financial and technical assistance modernizing the railway was able to revitalize Ethiopia's industrialization and economy by providing more opportunities for foreign trade and human resource exchange (Tovar, 2019; New China, 2018). However, although it was finished and inaugurated in 2016, trains did not start to operate until January 2018 (Tovar, 2019; The Diplomat, 2018). After that, Ethiopia had trouble producing enough electricity to power the railways (The Diplomat, 2020). The accompanying infrastructure was abandoned because the railway was not ready to enter commercial operation. Consequently, the Ethiopian government failed to generate the profits needed to repay the loan by operating the train service and agreed with China to extend loan repayments from 10 to 30 years (The Reporter, 2017).

2.4 Challenges

There are two main challenges embedded in the Addis Ababa-Djibouti Railway project. The first one is that the Chinese involvement in the project was exploitative without considering the local transportation system. It is important to take account of the transportation system in Addis Ababa because the railway cuts cross the city and is expected to deal with the traffic problems in the city. The Administration of Addis Ababa developed the Addis Ababa Transport Plan in 2007 and the Transport Policy of Addis Ababa in 2011 that led to the revitalization of the Anbessa City Bus Enterprise, the introduction of medium capacity PMT technology comprising Bus Rapid Transit and the LRT System, and the promotion of Minibus Taxi Services (Fenta, 2014). However, different modes of public transport across the city remained disharmonious given the very limited role public authorities played in the public transport sector (The Guardian, 2014). Also when the new railway was introduced, it was not incorporated into existing plans for the transportation system. How the locomotives operated was not fully discussed nor was the coordination with the other major forms of transport (Fenta, 2014). For example, new lines and new stations were planned rather than reusing existing stations, which did not engage with sustainable land use or urban planning (Urban age, 2018). Also, facilities did not reflect the local environment, so safety concerns were frequently raised by the community and pastoralists (The Economist, 2018).

Secondly, there is a lack of technical capacity in transportation in Ethiopia. During the initial stage of the project including the design, construction, and initial operation, customer needs assessments and profitability evaluations were not fully considered (The Diplomat, 2020). For example, the information and communication technology required to monitor, analyze, and predict the mobility patterns of the population is vital to understand the demand for transportation (Chen et al., 2019), which demonstrates its sustainability and profitability. However, these procedures were not fully implemented during this project. Due to Ethiopia's lack of technical capacity, the country's dependence on China for technology support had a negative impact on the project (Urban Age, 2018). Ethiopia was encouraged to choose state-of-the-art but expensive technologies rather than profitable ones (The Diplomat, 2020). Also when organizing capacity building and technology transfer, the CREC, a Chinese construction group, and the CCECC, a state-owned contractor were awarded the contracts to train local companies and their personnel in operation and maintenance. However, even capacity building was limited by the construction contractor's lack of knowledge and actual experience of operating and maintaining railways (Quartzafrica, 2019).

3. Analysis of best practice: The cases of Seoul Metro line 9 and the Shinbundang Line

As we demonstrated above when discussing the problems in Ethiopia, solutions can be identified by

examining lessons learned during preceding railway projects based on PPP model, and their best practices. We conducted two case studies of a successful PPP model in Korea to discover how to improve the public transport sector in Ethiopia with a PPP-based railway business model. Even though there are some gaps between Korean case and Ethiopian case to apply directly in terms of experience, level of knowledge, different environments economically and socially, Korea can share its experience and knowledge to connect transportation with PPP model based on TA funded from ODA. The two representatives were the Seoul Metro line 9 and Shinbundang line which are examples of best practices for constructing a public transport system based on a PPP model. Firstly, Korea considered private investment in Seoul Metro line 9 as a prior option to mitigate the financial burden after the 1997 financial crisis. At the moment, 87% of Seoul Metropolitan City's debt is related to subway maintenance and operations; therefore, Seoul developed a PPP-based business model based on the co-investment and cooperation of the public and private sector to develop Seoul Metro line 9 and overcome the debt problem.

To mitigate fiscal deficit and improve the efficiency of railway operations, the first 25.5 km of Seoul Metro line 9 was developed using a PPP-based business model. The operation of Seoul Metro line 9 was privatized for 30 years from 2009 to 2039. Meanwhile, 4,800 billion KRW of the 9,000 billion KRW construction cost was derived from the private sector, and the public sector took charge of the rest, implementing a combined financing approach (Hong et al., 2014).

The PPP-based business model has produced added value in operational stages by providing solutions to complex problems, where co-financing by the public and private sectors to extend the subway line and a fixed-year transfer to the private sector aimed to create profit. During the first stage of the Seoul Metro line 9 development that agreed to operations and business management, the contract specified that prior negotiations with the Mayor of Seoul should proceed in case the private operator wanted to raise the subway fare. According to the early-stage plan, the public and private sectors agreed that the subway fare would be raised by 3.41% to match the inflation rate for ten years from the first operation year. Nevertheless, Seoul was concerned that increasing the subway fare to more than the other subway lines could burden of citizens who used Seoul Metro line 9. Accordingly, Seoul adjusted the plan in consultation with the private sector so that the line 9 subway fare could be fixed for three years from 2009 at 900 KRW and 1050 KRW from 2012 (Public Investment Institute, 2014).

However, during real business operations, an unpredictable problem occurred since the passengers were less than predicted resulting in the deterioration of private profits. To overcome this, both the public and private sectors negotiated the public financing of compensation for the private sector deficit. The public and private sectors agreed on a revenue model that enabled the private sector to run the business itself using public investment although the private burden would be greater until the number of passengers increased. As a result, from 2012 the subway fare for line 9 was raised by an additional 500 KRW more than the other subway lines operated by Seoul Metropolitan Rapid Transit Corporation. Currently, the private sector shares the financial risks with the public sector, and the provision of a stable service to citizens has led to an increase in the number of passengers that can sustain subway line operations (Envelops, 2019).

The lesson learned from the PPP-based business model for Seoul Metro line 9 is that a remarkable PPP model can mitigate the investment burden, especially for large-scale infrastructure projects such as railway construction. In addition, although during the initial operation stage the predicted revenue model failed, a PPP-based cooperative business model can overcome such problems through co-financing and risk-sharing.

The second best practice PPP-based business model in the transport sector is the Shinbundang line in Korea. The Shinbundang line was constructed in line with a MP for urban development to promote accessibility and connectivity between large-scale residential areas in Southern Seoul, and emerging commercial and industrial areas in Bundang and Yongin. Although the Bundang line had connected these areas, the facilities were run down

leading to a decrease in the number of passengers and intensified traffic jams. Thus, to overcome these problems, a new railway line connected to related urban planning was considered a necessity, and the Korean government decided to construct the Shinbundang line. In 2001, the Korean government decided on the preferential development of the first section of the Shinbundang line by conducting a feasibility study. The results determined the additional development of the remaining sections, and a PPP-based business model was suggested.

The construction of the first section between Gangnam and Jeongja began based on a contract between the private sector and the government. In 2011, the Shinbundang line was converted into a Build-Transfer-Operate business. While the government had ownership of the Shinbundang line, the private operator has sole operation rights for 30 years. The first 20.8 km section has six subway stations and based on a construction cost of 1,200 billion KRW, 54% of which (661 billion KRW) was financed by private investment (Kim et al., 2016).

Consistent with Seoul Metro line 9, the prediction of demand for the Shinbundang line failed. Since the railway service was postponed due to a prolonged construction period, passengers using the Shinbundang line amounted to only 30 ~ 40% of predicted demand. Furthermore, while free riders suing a senior pass were predicted at 5%, in reality, they accounted for 17% of total passengers, so that net revenue was much less than predicted (Envelops, 2019). However, the cooperative PPP-based business model mitigated the government's financial burden by not specifying the subsidy required to guarantee a minimum profit (Kim et al., 2016).

For the sake of profit generation, the current Shinbundang line fare has been set at 1,750 won, which is 700 won more than other routes. The integrated rate system reduces the burden on citizens who are the actual users. The second lesson learned was that a different revenue model was required, unlike the previous line 9, where the private profit model combined with public transportation management was properly harmonized and users' economic burdens minimized. This has helped to provide a stable transportation service.

4. Conclusion

The results of our advanced qualitative analysis and literature analysis indicate that the traffic problem in Addis Ababa, the central city of Ethiopia at present, is due to an imbalance in the demand for and supply of public transportation, a system where only light rail is used, and additional public transportation such as buses or taxis that can be linked after using light rail. The major problem is the shortage of transit infrastructures, but before constructing them, it is necessary to consider the lack of a strategic traffic management system for preventing the transportation disharmony between the new ones and existing. The traffic system is an opportunity to accumulate the country's experience on the connection the transportation and PPP for preparing the future projects related to the mass transit infrastructure. In addition, the analysis of public transportation demand has been relatively poor due to a lack of expertise in predicting future transportation demand or establishing plans that meet demand. Furthermore, results confirmed that there is no traffic management system in Addis Ababa due to the lack of transport infrastructures such as pedestrian roads, buses, and taxi stops in the city as a whole, and the lack of established laws and systems to govern them. The biggest problem facing the Ethiopian government right now is that the light rail that was built to solve the traffic problem in Addis Ababa was promoted with a loan from China, and is designed to repay the profits earned from the operation of the light rail to China. However, as mentioned above, since it was not possible to solve complex problems related to this project, the number of customers using the light rail service was far lower than expected, and the cost of installing light rail that had to be paid back to the Chinese government has piled up as national debt.

Therefore, a step-by-step approach to promoting the effective use of light rail to improve the traffic problems in Ethiopia is required, and a connection between the ODA and the PPP business model is necessary to secure long-term and stable financial resources. Based on the best practices implemented by other countries, technology

transfer should be attempted, but through localization rather than exploitation. Capacity building is required to realize this and overcome problems autonomously, and institutional improvement should be supported. According to Pessoa (2008), the PPP model, which requires private financial resources, is being used as a new strategy for acquiring ODA in developing countries after implementing pilot projects using ODA resources. In addition, as demonstrated by Korea's excellent PPP model in the transportation field, it is possible to share the risk burden caused by failed demand prediction between public and private sectors with different characteristics. By sharing strengths and providing stable services, the financial burden of users can be minimized and the quality of services increased.

To solve Ethiopia's traffic problems, ODA resources should be used to identify existing transportation infrastructure, predict future traffic demand, assess system maintenance requirements, and finally, develop additional transportation using the PPP model. If these steps are followed it will be possible to achieve development objectives. To ensure the proper utilization of the PPP model, an institutionalized system must be established first, and transport infrastructure linked to overall urban planning. Further expansion should be conducted step-by-step and must be connected to utilization (Fig. 1).

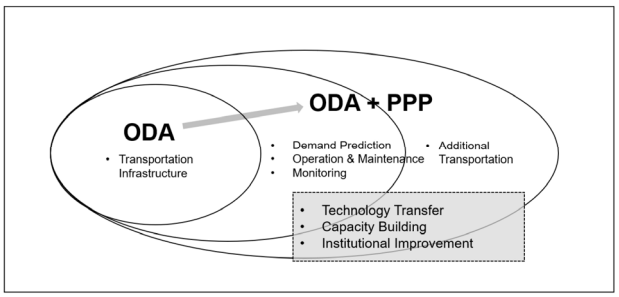

Fig. 1. Suggestion for business model development in Ethiopia transport sector

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