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Frugality in Multi-actor Interactions and Absorptive Capacity of Addis-Ababa Light-Rail Transport ¹

Abstract

Cities in transition need strategies to do more and better using less or limited resources, to be frugal in their approach, especially when implementing expensive infrastructures. Addis-Ababa city, Ethiopia in recent years acquired the Light-Rail Transport (LRT) from China, which entails different multi-actors interacting to achieve resource efficient LRT in terms of cost, technical know-how and time. Addis-Ababa re-organized their organizational structure to interact with multi-actors, in providing affordable LRT, measurable technological transfer and learning routine via structured absorptive capacity, delivering an environmentally sound electrified light-rail, as a zero-carbon emission transport system. Using mixed research methods, consisting of light-rail expert's semi-structured interviews and a passenger survey, this article aims to know how the multi-actor interaction processes and absorptive capacity structures have delivered frugality in urban rail transport. Thus, delivering the LRT, despite inadequate country owned financial resources, less technological and knowledge capability of LRT, within a limited period of three years. Results show that frugality strongly depends on the structure of absorptive capacity and process of multi-actor interactions. In addition, tacit knowledge developed by Addis-Ababa, as an existing knowledge base is vital in harnessing the explicit knowledge provided by China. This frugally delivered light-rail consequently brought changes to the low-income passengers, also known as Bottom of Pyramid (BoP) passengers and a fraction of modal shift from other motorized transport modes to the light-rail public transport.

Keywords: Frugality; multi-actors; absorptive-capacity; Bottom-of-Pyramid; modal-shift, Light-Rail Transport, LRT.

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1.0 Introduction

Scholars within the technological capability school of thought, argue that developing economies should not linger-on, in a stagnant mode, as recipients of technologies transferred from the global North. Rather, these economies must embark on appropriate measures towards the adaptation and integration of the transferred technologies, despite complexities within the multi-actors (Bhaduri, 2016).

One out of three extensive innovation heuristics used in achieving frugality in service is identified as innovatively decreasing time wasting, human resources and materials to reduce cost and increase effectiveness (McNicoll, 2013; Mukerjee, 2012; Prabhu & Gupta, 2014). Little attention has been given to the study of frugality and frugal innovation as a non-technological and governance network related component, as this topic has been conventionally viewed from the technological and hardware related domain. However, frugal processes are alive and well in the institutional infrastructures of governance networks in cities. Till-date, most focus has been given to frugality and frugal innovations from the viewpoint of management (Prahalad, C. K. & Hammond, 2002; Prahalad, C. K., 2005; Radjou, Prabhu, & Ahuja, 2012; Zeschky, Widenmayer, & Gassmann, 2011) and technology (Altamirano & Van Beers, 2018). However, we still know little about how frugality is realized and delivered especially in the practice of international collaboration. In this article, Light-Rail Transport (LRT) is approached in the context of frugality amongst Multi-National Corporations (MNCs).

There is a need to critically and systematically investigate how frugality and frugal innovation outcomes in different parts of the world correlate to development, to effectively measure its transformational or developmental potential (Leliveld & Knorringa, 2018). MNCs are progressively occupying cities in-transition and informal economies with frugal innovations, while local authorities, social entrepreneurs and Non-Governmental Organizations (NGOs) gradually endeavor to bring the local and frugal innovation practices to balance (Leliveld & Knorringa, 2018). A frugal viewpoint to development research is to classify under what circumstances such innovation processes are expected to contribute to more inclusive developmental results. In this sense, a critical and multidisciplinary method to frugal processes as well as an empirical approach is needed (Knorringa, Peša, Leliveld, & Van Beers, 2016). This need serves as one of scientific importance in this article, as it delves into the processes of how frugality is achieved through the combination of stakeholder dialogues in multi-actor interactions and tacit knowledge in absorptive capacity. In addition, considering the effect of this combination on the low-income earners, i.e., the Bottom of the Pyramid (BoP), as an inclusive developmental outcome.

Therefore, the aim of this paper is to know how the multi-actor interaction processes and absorptive capacity structure amongst the multi-actors have delivered frugality in LRT, what are the effects of the changes by the new LRT on the low income earners as the BoP? and whether there has been a modal shift from other motorized vehicles to the LRT?. What effect has this had on implementing the LRT despite inadequate country owned financial resources, less technological and knowledge capability of LRT and within a limited period of time? Furthermore, the study aims to provide societal relevance for decision and policy makers, with the understanding of how to organize their multi-actor interaction processes with the MNCs and how to structure their absorptive capacity in order to make optimum use of their limited financial, time and human skill resources. These important needs are also gears towards the achievement of the ninth Sustainable Development Goal (SDG-9), stated as:

“building resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation” (United Nations, 2015)

as efficient transportation services generate employment and wealth and drive economic development.

The present-day dialogue on frugality in decision theory attempts to draw a conceptual roadmap to aid us fathom out frugality in the context of decision making (Gigerenzer & Todd, 1999; Gigerenzer, 2008). According to these authors, we need to analyze both the person taking the decision and the environment in which the decision has been taken, in order to comprehend frugality. Frugality needs to therefore, emphasize not only what is achieved, but likewise and possibly more importantly to know how it is achieved. In the context of this article, frugality is defined as the process of adaptation, adoption, invention, transformation and appropriation, not just of products but likewise of systems, not simply technological and scientific systems and products, but including all institutional, organizational, social, and political dimensions (Leliveld & Knorringa, 2018). Similarly this articles also focuses on the institutional and organizational aspect of frugality, which is visualized in the multi-actor governance network and absorptive capacity, within the transport institution of Addis-Ababa Light-Rail Transport.

Section one is the introduction. Section two depicts the theoretical framework; section three focuses on the methodology, section four is comprised of the empirical results and discussions; and section five contains the conclusions.

2.0 Theoretical Framework

The absorptive capacity concept is derived from three model theories. First is the theory of frugality in decision-making, to understand and highlight the role of tacit knowledge and learning strategies (Bhaduri, 2016). This theory describes a framework, which highlights three main characteristics of frugality in decision theory.

- A search process by means of simple classified stages and intuitive thinking, rather than explicitly-defined instruction-based choices; Proactive steps to adapt to the environmental challenges via demonstrated capacity for imitation and learning; Focus on concrete performance, feasibility and effectiveness rather than scientific or logical validation
- Second is the theory of process in local capability formation in explicit and tacit knowledge transfer (Ernst & Kim, 2002), between network flagships. which refers to MNCs or LRT innovation suppliers and local suppliers, i.e. local knowledge receivers or the innovation receiving city or institution
- Third is the theory of absorptive capacity for new knowledge as part of system antecedents for innovation (Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004). The absorptive capacity concept was used because there is a need to understand how ERC fostered the management for the acquisition of knowledge transfer from the Chinese Consortium (CS). This is because knowledge transfer is one of its Key Performance Indicators (KPI), which makes it important to focus on, as it enables the context of frugal approach.

In this context these frugal approaches are in managing the three major and related resources namely; limited budget, limited time and technical knowledge transfer for human resources to deliver the LRT

The multi-actor interactions concept emanated from two model theories. The theory of inter-organizational norm-setting and networks in outer context in the implementation of innovations in health service delivery organization (Greenhalgh et al., 2004), and the theory of sustainable collaboration (Fadeeva, 2005). In this research the multi-actor interaction concept was used because of the interactions between the ERC with four other multinational corporations, and to understand the patterns of their multi collaborations as a governance network.

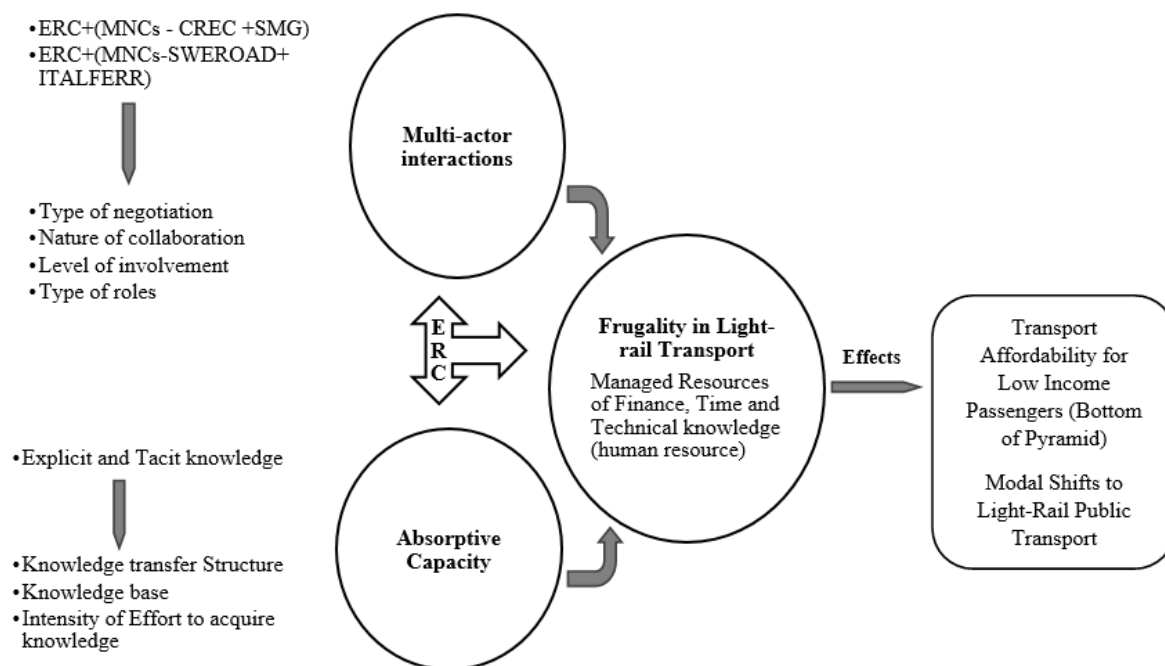
The frugality concept originates from the theories of frugality and frugal innovation for resource management, such as finance, time and technical knowledge (human resource), to do more or better with less or limited available resources (Bhaduri, 2016; Knorrninga et al., 2016; Leliveld & Knorrninga, 2018; McNicoll, 2013; Mukerjee, 2012; Pisoni, Michelin, & Martignoni, 2017; Prabhu & Gupta, 2014; Tiwari & Herstatt, 2012).

The BoP concept is derived from two theories. First is the theory of business opportunities at the BoP, as a market base method to alleviate poverty (Hammond, Kramer, Katz, Tran, & Walker, 2007). Second is the theory of eradicating poverty by MNCs earning revenues at the BoP, generating mutual value (Prahalad, Coimbatore Krishnarao, 2002). The base or BoP, denotes to four billion persons in emerging economies, which is a high and significant part of the world's population (Hammond et al., 2007). The annual per capita income of these four billion people is less than \$1,500 per year (London & Hart, 2004; Prahalad, C. K. & Hart, 2002). \$1,500 per year is considered as the minimum to sustain a decent life (List, 2017).

The modal shift concept is coined from the travel behavior theory, which in transport planning is traditionally divided into four parts in a model acknowledged as the four step model (Ortuzar & Willumsen, 2006). This deals with the behavior of humans regarding travelling decisions. This paper is concerned about the third part of the model, which is the modal choice, describing the transport mode in a given trip, therefore relating the modal choice as a measure for modal shift, because it is when passengers change their mode of transport to another mode that it reflects the modal shift based on different factors, such as affordability, comfort, safety, reliability, etc.

The theoretical framework shows the relationships between multi-actors² interactions, and absorptive capacity, leading to frugality in LRT and its effect on the transport affordability of the BoP and modal shifts to LRT.

² Ethiopian Railway Corporation (ERC), Multi-National Corporations (MNC's), China Railway Engineering Corporation (CREC), Shenzhen Metro Group (SMG) Swedish National Road Consulting (SWEROAD), Italian State Railways Group engineering firm (ITALFERR).

Photograph 1: Theoretical framework

2.5 Methodology

The research strategy is a mixed method, using a single case study. These mixed methods used a qualitative approach which has a pilot and semi-structured interview, and a quantitative approach which used a survey method. The qualitative approach, provided instruments for researchers to study complex phenomena within their contexts, which can be used by professional practices and serves as evidence-based decision making in policy settings (Baxter & Jack, 2008). This research uses the specific case of Addis-Ababa city LRT, with specific context of how the variables are related to one another, during multi-actor interactions between the MNCs from China, Italy, Sweden and ERC in Addis-Ababa.

The case studies provides a more robust understanding of the social characteristics of adoption of innovation (Lawrence & Tar, 2013), in infrastructure provision and outcome of events (Radcliff, 2013). In addition, in the case of public transport institutional analysis, variables are better analysed qualitatively, which needs in-depth methodologies (Altmann & Engberg, 2016), such as semi-structured interviews, providing deeper and more comprehensive data (Groves et al., 2009), enabling the researcher to analyze the specific context of the study and to take into consideration the actors actions and interactions (Santander, 2013).

The case study was conducted using a two-step approach of (a) pilot interviews using open-ended questions as a pre-test, carried out in 2015 followed by (b) two rounds of in-depth interview using semi-structured questions, first round in 2015 and second round in 2017. The reason for doing a second round of interviews in 2017 was to capture the operational phase data, which is well enriched with more related concepts of the research, issues and experiences after two years of operation.

Both approaches had a total of twenty-two respondents, five pilot in-depth interviews in 2015, six semi-structured interviews in 2015 and eleven semi-structured interviews in 2017. The pilot provided a credible and sound research approach and interview protocol (Willis, 2005), in which the pilot confirmed which variables should be measured and if they were actually relevant to the study area, as the area of research is a relatively new study area. The analysis from the qualitative analysis gave descriptive statistics, categorizing of the various levels of data, generating a robust data set, deducing categories and patterns, using Atlas-TI software.

The quantitative approach entailed the use of a survey questionnaire for a total of 254 passengers. These 254 respondents comprised of passengers along the North-South (N-S) line and East-West (E-W) line. The sampling method used was the purposive sampling method it was selected because it was based on characteristics of the population of LRT passengers along the two available N-S and E-W lines in operation and the objectives of the study. The analysis from the quantitative approach produced descriptive statistics, using the Statistical Package for the Social Sciences (SPSS) software. The analysis from the qualitative approach included the coding of responses from the LRT experts to form reliable trends and validate responses based on the number of occurrences using the ATLAS-TI software.

2.6 Empirical results and discussion

This section starts with the characteristics of the LRT, then presents the empirical results and their related discussions based on multi-actor interaction processes, absorptive capacity, which leads to frugality in light-rail transport.

- The total length of the LRT is 34.25 Km, which is currently sub divided into two lines within 41 stations, namely North-South (NS) line - 16.9 Km and East -West (EW) line - 17.35 Km.
- The network is designed to carry 15,000 passengers per hour per direction (PPHPD) and 115,000-153,000 passengers per day (PP/PD).
- The two lines share a section of track in the city centre.
- The LRT has a maximum service speed of 80 Km/h
- It has a capacity of 80,000 passenger/hour (PPH)
- 286 passenger carrying capacity,
- Headway time of 6 minutes, but presently experiencing 10 -15 minutes headway time due to inadequate LRT vehicles compared to the travel demand.
- It operates between 16-18 hours per day (Jemere, 2012).
- The fare costs of 2, 4 and 6 ETB for short, average and long distance respectively per NS or EW line trip (Jemere, 2012).

2.6.1 Frugality in Light-Rail Transport

The processes of how frugality in Light-Rail Transport was achieved are:

Frugality of Time Resources

Frugality was achieved with time as a resource in the following phases of time periods during the light-rail project:

- (a) *Design Phase Period:* This was characterized by ERC's timely interaction with city level authorities, such as Addis-Ababa road authority, city water and electricity companies,

city telecommunication provider, etc., to incorporate their activities and assets with the needs of the LRT. In addition, and very importantly, resolving the third-party issues arising from the privately and publicly owned assets along the LRT routes.

- (b) *Construction Phase Period*: Multi-actors' interaction between ERC and other MNC's – CREC, SMG, SWEROAD and ITLAFERR, was facilitated by ERC to timely construct the components of the LRT. This was also managed using the stakeholder dialogue method, having some of the steering committee members involved at every main construction facet. This ensures that most of the contracts within the different phases were approved as quickly as possible, not exceeding any of the stipulated periods of construction.
- (c) *Operational Phase Period*: The structured absorptive capacity, aided a timely technology transfer of knowledge, which ensured that only Ethiopians were driving the LRT after six months of starting the operation. In addition, major parts of the operation and maintenance were handled by the Ethiopians between two-three years after operation. This saved Addis-Ababa city via ERC, a significant amount of money, which would have been used to pay the Chinese in foreign currency, costing more as extra expenses, if the locals were not technically empowered within the right period of LRT implementation.

Frugality in Technical Knowledge (human resource)

In acquiring light-rail technology transferred from China, ERC used tacit knowledge as a form of absorptive capacity to structure its knowledge transfer to acquire the Chinese explicit knowledge. Frugality was achieved in human resource, as extra costs were avoided in extending the five years concession to the Chinese, via appropriate knowledge gap filling by the Ethiopians, who received technical training a few years before, during and after the operational phase of the LRT. In addition, significant component of training on future routes of LRT in Addis-Ababa will be done by the Ethiopians, saving costs of hiring fresh hands from abroad and reduced costs of salaries during the implementation of the proposed expansion of the LRT routes in Addis-Ababa.

Frugality in Finance

Using the limited available finances, borrowed as loans from China, Addis-Ababa city controlled the use of this resource through efficient use, because of both frugality in human resources and time. Frugality in human resources and time ensured that frugality is achieved in finance, because it aided expenditure in a more prudent manner, avoiding the request for more loans, which may have been required if the time of completion had been delayed and inflation had set in, affecting Addis-Ababa's counterpart funding and costs for components of the rolling stock. Thus they managed to save costs in the present and future implementation of the LRT in Addis-Ababa. As mentioned by a top director,

"We did not have any reason to spend more than we budgeted for. This is because all components of the LRT were done within time, avoiding any form of significant inflation of foreign currency for our counterpart funding and 50% of our workers have presently taken over the LRT operations and maintenance, which is paid in our local currency".

2.6.2 Multi-actor Interactions

Multi-actor interactions defined in this context as the Multi-stakeholder group collaboration. These collaborations vary broadly for its type of interactions and nature of collaboration, in terms of their size, goals, membership and actions (Fadeeva, 2005). The multi-actor interactions use mainly the stakeholder dialogues and sometimes formal negotiations, which fosters frugality,

despite differences in interaction, culture and methods of implementing infrastructural projects. During these negotiations and dialogues, some actors are more active than others, some serve more as coordinators providing rules for check and balances, financier based on concession, provision of technical expertise.

These negotiations and dialogues were achieved as ERC coordinated the city authority organizations and the MNCs, with limited tradeoff's as much as possible, ensuring less cost increment as a result of certain tradeoffs between the MNCs and city authority organizations, such as resettlement claims, electrical and communication utility transfers by the utility companies, city government building demolitions to allow for LRT route space, right of way issues with other road vehicles, crossing distance allowed for pedestrians between LRT stops due to safety barricades along the LRT routes, etc. For example, as mentioned by one of the Ethiopian LRT experts:

“We the ERC, facilitate a stake-holder dialogue with the related city authorities on behalf of Ethiopian government and Chinese consortium, as a form of informal dialogue, because some of our requests are not legally mandatory, as the LRT route was not in the Addis-Ababa master plan. So, we seek their support to carry out certain activities, such as relocation of their buildings through demolition along LRT routes, relocation of water ways, electricity and telecommunication cables and land reallocations”.

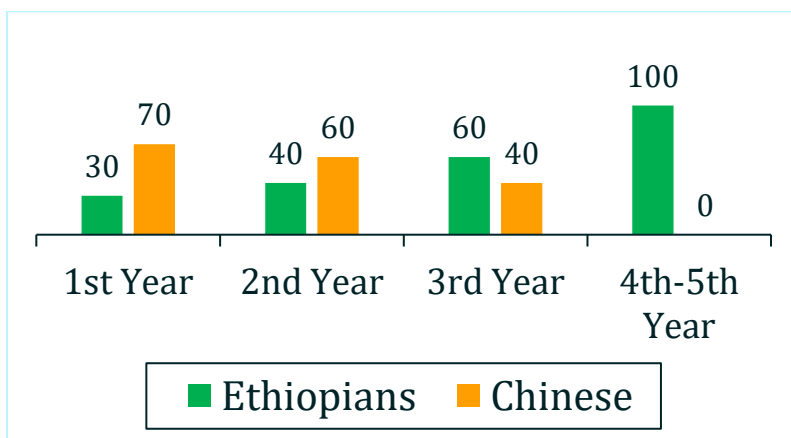
Thus, by interacting with the MNCs and city organizations to minimize the cost effects of each tradeoff were capable of increasing the stipulated budget and time spent on each construction stage, leading to a frugal approach during interactions with the multi-actors.

The multi-actor interactions that took place within the LRT adaptation processes between the Addis-Ababa and Chinese counterparts, focused on their roles and responsibilities, types of negotiations during the design, construction and operation phases, Key Performance Indicators (KPI's), resource management (financial, time and human).

2.6.3 Absorptive capacity

A structural framework to acquire the knowledge was setup using strategies, namely: Knowledge transfer ratio plan; Medium- and long-term training; Nineteen (19) mainstreams and certifiable positions in operations and maintenance; and pairing of every Chinese manager by Ethiopians in the main departments.

Figure 2: Knowledge transfer ratio plan



2.6.4 Reasons Why Multi-Actor Interactions and Absorptive Capacity Contributes to Frugality in Light-Rail Transport

The main stakeholder dialogues were about occasional formal negotiations by multi-actors and the use of absorptive capacity contributes to frugality in light-rail transport. This was because, the theory of frugality in decision-making theory with regards to the absorptive capacity concept shows that ERC used classified stages to develop the technology transfer into different training classes, ratio-plan stages and learning strategies (Gigerenzer & Todd, 1999; Gigerenzer, 2008).

In addition, proactive steps of imitation and learning were used to adapt to particular context challenges in Addis-Ababa via demonstrated capacity to adapt. There was also a focus by ERC on concrete performance, feasibility and effectiveness rather than scientific or logical validation, achieved through structured learning, imitation and tacit knowledge for actual performance, such as taking-over specific operational and maintenance activities within a stipulated time.

From the same perspective, frugality in Light-Rail Transport did not only highlight what was achieved in technology transfer from China to Addis-Ababa, but more importantly how it was achieved in the absorptive capacity and multi-actor interaction processes (Gigerenzer, 2008). Furthermore, it gave the local authorities a competitive advantage because they regularly possess tacit knowledge about the particular local conditions, needs and local desires (Leliveld & Knorringa, 2018). This was realized from the use of tacit knowledge by the LRT receiving corporation – ERC in Addis-Ababa city, within unique and particular local contexts. An approach by MNCs included in designing, constructing, marketing or operating frugal innovations was consequently to involve local innovators and entrepreneurs in polycentric innovation and business networks, so that they were able to benefit from this valuable knowledge (Leliveld & Knorringa, 2018).

2.6.5 Effects of Fare Affordability and Pricing by Zone Distance on Bottom of Pyramid (BoP)

The new LRT was able to cater for the transport needs of the BoP through the provision of an affordable ticket fare price and structure. This fare structure that was provided by the multi-actors for the passengers was a zoning system of 2, 4 and 6 Ethiopian Birr ETB³. The two ETB fare was for short distances, passengers travelling within a certain short zone or few LRT stops. Four ETB fare was for intermediate distance travelled. Six ETB fare was for long and end-to-end distance travelled. *The multi-actors used the competition based method* (Kozlak, 2007; Rokicki, 2014), where the price is determined and reduced on the basis of price analysis of competing services, such as competing private bus and taxi operators, and public bus operators (Kozlak, 2007, Rokicki, 2014). This was used as a benefit because it supports the provision of more affordable transport fare to the BoP, as compared to other main public transport modes, for the low-income earners to easily migrate to the LRT, which has a lower price than its competitors (Pansera and Owen, 2015). Out of 254 total passengers as respondents, 66.7% of the passengers perceived this ticket fare as affordable (just OK), 21% perceive it as very affordable; while 9.7% perceive it as expensive (not affordable). This brings the total percentage perceived by the passengers on affordable ticket pricing in general to 87.7%, *thus fulfilling the target for the low-income passengers at the BoP, to increase accessibility and foster inclusion.*

³ (ETB) Ethiopian Birr - Ethiopian national currency, with an equivalence present rate of 29 ETB to 1 USD (dollar) (December 2019)

The household survey of urban transport study in 2004/2005, revealed that the average household size of Addis-Ababa is 5.08 of an average age range from 18-40 years, and income level is low with an average household monthly income of 725 ETB (Abreha, 2007). Assuming a 15% inflation rate in the last decade, *the present average household monthly income can be approximated as 870 ETB*. Almost 50% of the population live below the poverty line, i.e., less than 500 ETB per household per month, and approximately 23% are in total poverty, i.e., less than 300 ETB per household per month (Abreha, 2007). Based on the occupation type of the 254 passengers surveyed, 62% of these passengers belonged to the *bottom of the pyramid as low income earners, earning between less than 300 to 550 ETB*. They were petty traders, street hawkers, shoe repairers, roadside traders, and the unemployed.

In addition, 85% of these 254 passengers do not use private cars as one of their modes of transport, as deduced from their modal combinations. While the remaining 38% of passenger's occupation status showed that they belonged mostly to the middle-income earners and few passengers were upper income earners. Most of the upper income earners still prefer to use their private cars and are not yet willing to change modes of transport.

The positive consequence here is that, the more affordable LRT has made some part of BoP passengers to change their modal choice of transport from other public transport modes to Light-Rail Transport. This is partly due to the fact that the LRT has fare rates which are slightly more affordable than the white and blue minibus taxis, alliance buses and higher midi-buses, which have a price range from 2.5 ETB for 2.5 - 7 Km, 4.5 - 5.5 ETB for 8 - 15 Km, and 7 ETB for 15 - 25 Km.

The LRT to a significant extent were more affordable than the salon taxis, which cost at least triple the price of the LRT, depending on the distance covered, and were usually patronized by the mid and high-income earners. The LRT is slightly less affordable than the Anbessa city buses which were predominantly used by the BoP's, with cost ranging from 1 ETB for 6 - 12.4 Km, 1.75 ETB for 9 - 13 Km, 2 ETB for 13 - 15 Km and 10 ETB for 47 - 50 Km. In this regard, a fraction of BoP's using the other modes of transport, especially those with proximity to the LRT, have a better choice of shifting to the LRT, which has better safety, reliability, comfort, and cheaper fares except with the Anbessa city buses. This modal shift has been proven during the high peak-hour rate patronage of LRT per day in Addis-Ababa. The LRT has also provided an alternative to the use of taxis and other bus types by the middle- and high-income passengers.

2.6.6 Effects of New Light-Rail Transport as a Modal Shift from other Motorized Modes to LRT

An important change to the city due to the new LRT is the *modal shift from other modes of motorized transport to public LRT*. To depict the extent of modal shift, the estimate for other transport modes capacity shows: 487 Anbessa city buses had a passenger capacity of 30 sitting and 70 standing, 10,000 white and blue minibus taxis with passenger capacity of 12 sitting, alliance buses with a passenger capacity for 40 sitting and 60 standing, 460 higher midi-buses sitting 22-27 passengers, 366 additional vehicles and 6500 salon taxis sitting 4 passengers (Fenta, 2014). Anbessa city buses were the most patronized mode of transport by the BoP, because it is the cheapest compared to other modes of transport. The Anbessa city buses were also characterized by 730,500 passengers per day with 100 passengers per trip, through 93 routes, average total of 6,352 daily trips, with the shortest route being 6.8 Km, the longest route is 47.2 Km and the total route length of 1207 Km (Abreha, 2007).

Considering the 153,000 passengers that currently use the LRT to the closest mass transport like the Anbessa city buses, which carries 730,500 passengers per day, is for now only 21% (153,405) of the passengers from Anbessa city buses. This justifies the plan by the ERC to purchase more LRT vehicles and open more routes, as an addition to the existing 41 LRT vehicles, to accommodate the high travel demand for the LRT and transportation needs of the over 4 million Addis-Ababa population (WPR, 2019). Presently, as a top director in the operations department affirmed;

“We hardly have off-peak periods, the people of Addis-Ababa embraced the LRT more than we had ever expected, and most of the day could be considered peak periods, as the LRT is most of the time full to its total capacity.”

This gradual modal shift will consequently reduce congestion on the roads and reduce the level of CO₂ emissions, as the 275,500 Addis Ababa vehicles are releasing between 25,000 and 32,000 tons of hydrocarbons and 49,000 to 58,000 tons of carbon monoxide into the city’s air annually, which is two to six times higher than World Health Organization standards (Benjaminson, Shankute, Torgerson, Gebre, & Gallavan, 2012).

2.5 Conclusion

The conclusion chapter shows how the combination of multi-actor interactions and absorptive capacity has delivered frugality in light-rail transport, and its effect on the BoP as an affordable transport fare than most of the existing modes of transport. What the possible added values could be for the benefit of future scientific studies have also been mentioned. In addition, it provides recommendations to decision makers on how to meet the demands of most of the BoP through vertical equity service for low income group targets.

2.5.1 Multi-actor Interactions and Absorptive Capacity Delivers Frugality in LRT

Results of the overall framework vividly shows that frugality in LRT strongly depends on the structure of absorptive capacity and the process of multi-actor interactions, especially as designed by the LRT receiving country. In this regard, the structure is related to structured absorptive capacity, provided knowledge transfer ratio plan, medium- and long-term training, knowledge transfer division into 19 mainstreams and certifiable positions in operation and maintenance, pairing of every Chinese manager by Ethiopians in the main departments.

Processes relate to how ERC as the main actor interacts with other multi-actors. They mainly communicated via the stakeholder dialogue and some formal negotiations to interact between the Addis-Ababa city authorities and MNCs. The stakeholder dialogues led as the main type of multi-actor interaction, while the formal negotiation followed and provided the benefit of complimenting the stakeholder dialogues, especially when the stakeholder dialogues reached a standstill, formal negotiations were used to settle conflicts during interactions.

The stakeholder dialogues also provided a soft-landing benefit for the formal negotiations to stimulate faster approvals and avoid bureaucracy to a reasonable extent. The combination of these absorptive capacity structures and multi-actor interaction processes, amongst ERC, MNCs and Addis-Ababa city authorities, to a large extent, enabled them to deliver frugality in Light-Rail Transport during the implementation phase, despite inadequate country owned financial resources, less technological and knowledge capability of LRT and the limited period of time resource of three years.

Thereby addressing the research question, to a large extent with the main use of structured absorptive capacity and stakeholder dialogue processes during multi-actor interactions, managed to deliver frugality regarding finance and human and time resources in the development of the Addis-Ababa Light-Rail Transport. As the frugal approach during the interactions was able to implement the LRT, within the stipulated budget, planned time of three years and managed the human resources that were available through strategies of appropriate absorptive capacity from knowledge transfer.

In addition, the multi-actor interactions produced a fare structure, which provided a more affordable transport fare for the BoP passengers than most of the other modes of transport, providing them with an inclusive leverage to use the LRT, as a cheaper, safer and more comfortable form of public transport, compared to the other available public transport modes in Addis-Ababa.

Addis-Ababa re-organized their organizational structure to interact with multi-actors, in providing affordable LRT, measurable technological transfer and learning routine via structured absorptive capacity, delivering an environmentally sound electrified Light-Rail Transport and a zero-carbon emission transport system.

Policy makers can make use of vertical equity services to target economic equity of the poor (BoP) and non-poor (Geurs & Ritsema van Eck, 2001),. This is to foster the inclusion of less mobile people or economically disadvantaged groups for improved mobility. Such as incorporating special fare structures as a subsidy for BoP passengers, old age pensioners, disabled people and students to reduce financial exclusion and provide strict measures in the occupation of disabled seating areas that are provided in the LRT, as the physically challenged cannot struggle for space with able bodied passengers in the LRT.

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Annex

Table 1: Operationalization Table

Concept	Variable	Sub-variables	Indicators
Frugality	Resources	Type of resources	<ul style="list-style-type: none"> • Stipulated time used during three phases of design, construction and operation. • Level of budgeted finance used as compared to available budget • Level of Technical know-how acquired
Multi-actor Interactions	Type of interactions/nature of collaborations	<ul style="list-style-type: none"> ❖ Type of negotiations/dialogues ➤ Level of involvement ✓ Type of roles played 	<ul style="list-style-type: none"> ❖ Formal negotiations ❖ Stakeholder dialogues ➤ very active, active, slightly active or passive ✓ Coordinator providing rules for check and balances ✓ Financier based on concession ✓ Technical, Research and Development (R and D) or Expert organization, providing technical and innovative support for better decision making
Absorptive Capacity	Knowledge transfer	<ul style="list-style-type: none"> • Explicit and Tacit knowledge • Structure and Type of capacity building. 	<ul style="list-style-type: none"> • Knowledge transfer Structure • Initial knowledge base • Type of effort to acquire knowledge • Knowledge transfer ratio plans • Types of knowledge transfer streams • Types of approach to knowledge transfer.
Provision for Bottom of Pyramid (BoP) passengers	<ul style="list-style-type: none"> ❖ Methods of fare structure ❖ Ticket fare affordability and pricing by zone distance 	<ul style="list-style-type: none"> ❖ Zoning coverage system of 2, 4 and 6-ETB. 	<ul style="list-style-type: none"> ❖ Affordability of fare price per zone
Modal Shift	<ul style="list-style-type: none"> • Modal choice of LRT over other modes based on their particular needs 		<ul style="list-style-type: none"> • Use of LRT to replace other modes