

Post Completion Sustainability of Ethiopian Railway Project: The Case of Addis Ababa Light Rail Transit Project (AALRTP)

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Abstract This research work aimed at investigating Post Completion Sustainability of Ethiopian Railway Project with special focus on the Case of Addis Ababa Light Rail Transit Project (AALRTP). Any project is designed to produce continual benefits for some period of time for the project stakeholders. However, the concept of post completion sustainability is not yet recognized as a crucial and part of the project process in the developing countries like Ethiopia. Literature depicted that post completion sustainability is hardly applied as part of the project process as well as standalone process in the projects in the developing countries. This time, it is well recognized that the importance of civil infrastructure systems are essential in providing the range of services generally considered necessary to support a nation's socio-economic development and quality of life. Consequently, it is of the utmost importance to government, business, and the general to the public that these services are sustained over the long term by periodic replenishment of the physical systems that deliver them. The sustainability of any project including civil infrastructure can be measured using six dimensions: economic, environmental, social, technical, coordination, and communication dimensions. To lure these facts and to achieve the objectives of this study, qualitative research design and purposive sampling techniques were applied. In collecting the necessary data, observation, document analysis and interview were used in the study. The information were gathered from seven interviewees and for document analysis, feasibility study documents, conceptual documents, strategic plan documents which run 2003 -2007 E.C., pamphlets, brochures and other documents of Ethiopian Railway Corporation were used. The findings of the study indicate that, the concept of post completion sustainability is hardly applied at Ethiopian Railway Corporation in general and at AALRTP in particular. The major factors (economical, environmental, social, technical performance, coordination, and communication factors/dimensions) were not thoroughly applied in the project. Based on the findings of the study, recommendations, suggestions and research future work are forwarded in the study.

Keywords Sustainability, Project sustainability, Project sustainability management, Process Success, Railway Project sustainability, Railway Project, Ethiopian Railway Corporation, Ethiopia

1. Introduction

The importance of transport for the socio economic development of a given country is immense. The history of transport is largely one of technological innovation. Advances in technology have allowed people to travel farther, faster, explore more territory, and expand their influence over larger and larger areas. Now days, railway is one of the most widely used transport mechanism especially in the developed nations. Importance of railway transport as one of the most crucial systems in the world, which allows mass transport, very high speed, safety and durability [1]. Today, there is a growing demand of railway transportation

systems in the world including in Ethiopia for a short and long distance transport of passengers and goods.

The railway lines construction in Ethiopia was first started in October 1897 from Ethiopia to the port of Djibouti during the regime of Emperor Menelek II. The first commercial service began in July 1901, from Djibouti to Dire Dawa. By 1915 the line reached Akaki, only 23 kilometers from the capital, and two years later came all the way to Addis Ababa itself. The railway links Addis Ababa, the capital of landlocked Ethiopia, to the port of Djibouti in coastal Djibouti. Maintenance shops along the line are located in Dire Dawa, which grew up as the Imperial Ethiopian Railway depot for nearby Harar. The single-track 781 km railway has a 1,000 mm gauge, most of it on Ethiopian territory, and about 100 km in Djibouti [1]. Today the old line is out of service.

The Ethiopian Railway Corporation (ERC) was established as a new organization on November 2007 by

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Regulation 141/2007 of the Council of Ministers of the Federal Republic of Ethiopia. The Regulation Mandates ERC to develop railway infrastructure and provide passenger and freight rail transportation services in Ethiopia [2]. ERC was established with the following vision, mission and objective.

Vision of ERC

To see modern railways infrastructure and services and an efficient railway company that supports Ethiopian's endeavour in building a globally competitive economy, that uses electricity and connects the country's development centers and links with ports of neighbouring countries.

Mission of ERC

- To support the fast growing economy of the country through constructing modern railways infrastructure which is cost effective and that transports bulk freight within short period of time,
- To expand passenger railways transport services and enhance public mobility.

ERC's key Objective

- The key objective of ERC is to develop an integrated and high capacity railway transport system to ensure competitive and affordable transport.

Currently, ERC has planned to implement eight projects besides to Addis Ababa Light Rail Transit Project (AALRTP) [2].

No one can deny the contribution of these projects for the socio economic development of the country if the projects are properly implemented and successful. Project success as comprising of two components [3] [4]: success of the project itself, as indicated by time, cost, and performance subcomponents, and client success, as reflected by use, satisfaction, and effectiveness of the project in benefiting intended user. This can be materialized not only by giving due attention for the triple constraints but also for the contemporary project management issues like project sustainability management. Project sustainability management should be part of the project starting from initiation till the delivery of the project. Sustainability of any project can assessed using economic, environmental, social, technical, coordination and communication dimension. These dimensions have indicators that can be applied in different stage of project management lifecycle. It is in such way to assure the project products and services will continue to produce the expected benefits for specific time frame and for the targeted group. In connection to this, the researcher has a strong conviction that doing research in the area of post completion of sustainability of railway projects; a case of Addis Ababa Light Railway Transit Project is beneficial to learn more about the long-term sustainability management plan of this project, to seek new insights into the problems and challenges, and then be able to formulate the sustainability strategy framework for the project in the Ethiopian context.

1.1. Statement of the Problem

Post completion sustainability of any project is crucial than launching a project. Any project is designed to produce continual benefits for some period of time for the project stakeholders. However, the concept of sustainability is not yet recognized as a crucial process and as part of the project process in least developing countries like Ethiopia. Literature depicted that sustainability is hardly applied as part of the project process as well as standalone process in the projects in least developing countries.

The concept of project as a sequence of unique, complex, and connected activities that have one goal or purpose and that must be completed by a specific time, within budget, and according to specification [5]. Moreover, the definition by the author considers the scope, quality, cost, time, resources and risk constraints that operate on every project. The definition focuses on the success of a project that delivers products or services, which totally ignores the concepts of sustainability of the project. However, any project is designed to produce certain benefits for specific period of time after the completion of any project. The success of the project as explained in [6] is:

“.. a project is usually a means to an end rather than an end to itself, it is reasonable to want to know if the project is successful, whatever the end might have been. Herein lies a difficulty. The success of a project can be determined from the perspective of the means (the project itself) or the end (what it was intended or expected to accomplish) depending on the interests of the stakeholder. Furthermore, regardless of means or ends, expectations of what the project was to achieve and perceptions of whether it achieved them often vary among stakeholders. This makes determination of project success highly contingent upon the expectations and perceptions of different stakeholders, and when the assessment is made.”

The statement implied that the success of the project depends on different factors, such as from perspective of the project itself, the project expected to accomplish from the stakeholders perspective. These indicate that the continual expected benefits of the project after completion (sustainability of the project) are one of the factors to measure the success project.

Sustainability in construction and the perception in developing country as described in [7]:

Sustainability as a concept has only recently been introduced to the construction sector, and the development that is happening shows that sustainability and sustainable construction are not yet an integral part of decision-making and business practice. Sustainability is still seen as a "nice-to-have" addition to normal practice, and not as the main motivator that drives all business and development decisions.

Based on the above paragraph, it is possible to say that the

concept of sustainability in the developing countries is not a requirement rather a “nice-to-have” as an addition to normal practice. Our country, Ethiopia, is not unique for this.

The core problem of any project in developing countries are sustainability issues which are not yet an integral part of decision-making and business practice of any project. As any other developing country, Ethiopia is no exceptional for sustainability and sustainable construction problem. Since this research is concerned about the sustainability of a project, it is a great contribution in the field where there is no empirical work and thorough understanding on the concepts of sustainability project and an eyebrow in Ethiopian’s projects. Currently, Ethiopia launches myriad of projects to accelerate the socio economic development of the country. Out of which, Addis Ababa Light Railway Transit Project (AALRTP) is one of them. Unless such projects, for which billions of budgets are allotted from the scarce resources of the country, continue to deliver a continuous flow of benefits from a development intervention perspective, the benefits that accrue to the future generations will be compromised. The preliminary investigation of the researcher, which held from April, 2016 to June 2016 on AALRTP, reveals the prevalence of the problem of integration of sustainability issues during the initiation, planning, implementation, and monitoring & evaluation phase of AALRTP seriously. This is the driving factor for the researcher to investigate the post completion sustainability of AALRTP.

Research questions

The research questions of this paper are:-

- a) What are the factors that affect the continuation of the flow of benefits from railway development projects after completion?
- What are the major factors that affect the attainment or non-attainment of the sustainable flow of benefits in the case of AALRTP?
- What major risks to sustainability were identified at appraisal, design and during implementation, and how were they mitigated or are planned to be mitigated after completion?
- What are the implications of ERC’s approach to ensuring the sustainability of AALRTP? What and how should ERC do things differently to enhance post-completion sustainability of this project?

1.2. Research Objectives

1.2.1. General Objective

AALRTP is designed to provide a reliable, competitive, affordable and consistent form of transportation services with much safety, convenience and comfort to passengers than other means of transportation system. This can be achieved when the project is incorporating the concept of sustainability from the initiation to implementation stages. This paper deals with the post completion sustainability of the project. The general objective of the paper is to investigate the post completion sustainability of AALRTP.

1.2.2. Specific Objectives

The specific objectives of the study are:

- To explore the factors that affects the continuation of the flow of benefits from railway development projects after completion.
- To identify the major factors that affect the attainment or non-attainment of sustainable flow of benefits in the case of AALRTP?
- To investigate the major risks to sustainability at appraisal and during implementation, and how they can be mitigated during planning and implementation or will be mitigated after completion
- To identify the implications of ERC’s approach to ensuring the sustainability of AALRTP. Indicate or pinpoint the things that must be done differently by ERC to enhance post-completion sustainability of this project.

1.3. Scope of the Research

a. Theoretical Scope

It is undeniable that exploring the post completion sustainability of railway projects at ERC has numerous advantages for its development and the sustenance of the concomitant services. However, due time and financial scarcity to identify, collect, and process all railway projects for post completion sustainability; the study is limited only on AALRT Project.

b. Methodological Scope

Even if there are a number of research types, to investigate post completion sustainability of AALRT Project, the researcher applied descriptive research type since it focused on question of what is going on. Based on the researcher preliminary investigation, post completion sustainability concept is taken as an action that is required at the successful completion of the implementation of the project. Because of this, using exploratory, casual, and correlation research types are not appropriate. It is not the intention of the researcher to get insights too.

c. Geographical Scope

ERC have nine (9) railway projects throughout the country. However, the researcher only concentrates on AALRT project which is located in Addis Ababa due to the reason clearly stated above.

1.4. Significance of the Study

To provide a reliable, competitive, affordable and consistent form of transporting with much safety, convenience and comfort to passengers designing a project like AALRT is crucial to present the users an alternative means of transportation system if its long term benefits are maintained for expected period of time. This can be achieved when a project incorporate the issues of sustainability as part of a project. In this regard, the value of this research is outlined as follows:

- Since there is no empirical work and thorough understanding of project sustainability management in the Ethiopian context, it can be used as an eyebrow in the field;
- Provide a concert feedback information on post completion sustainability of AALRT Project to take a corrective action though it is too late;
- Used as a benchmark for the upcoming & under construction railway projects;
- Used as an input for other projects regarding sustainability management;

generations to meet their own needs” [8].

Sustainability can be assessed at the global level and over several future generations, with a focus on the resources used for and threats to human life. The basic idea of project sustainability is that any project should be designed to produce a continuous flow of outputs, services, and outcomes for a long time over its useful or economic life. Some definitions refer to the continuation of benefits after a project has been completed. Because sustainability includes project effects after implementation, some definitions refer to the likelihood that project results will be maintained over time. Project results should be sustainable even where there are several risks to outputs and outcomes; the notion of building resilience to risk is part of the reason for focusing on capacity development activities in a project scope, and for identifying mitigating measures [9]. Based on this, it is possible to say that Project sustainability refers to the sustainability of project effects rather than any particular project organization, which can be dissolved at the end of project implementation. Sustainability has been defined in many ways by many groups as described in table 1.1.

Of the many definitions available, perhaps the most applicable to infrastructure is that of the World Commission on Environment and Development 1987 [10]. However, sustainable development is still seen as a complex issue that defies definition for practical purposes.

2. Literature Review

2.1. Project Sustainability Management: General Concepts and Definition

a. Concepts of Sustainability

The concept of sustainability was launched in 1972 at the United Nations (UN) Conference on the Human Environment held in Stockholm, which was the first international symposium called to discuss exclusively environmental issues. The Brundtland Commission subsequently produced the most widely used of all the definitions of sustainable development: “sustainable development is development that meets the needs of the present without compromising the ability of future

Table 1.1. Definitions of Sustainability

ADB	The probability that human, institutional, financial, and natural resources are sufficient to maintain the outcome achieved over the economic life of the project and that any risks need to be or can be managed.
AfDB (African Development Bank)	The likelihood that project results will be maintained over the intended useful life of the project.
AusAID (Australian Agency for International Development)	The continuation of benefits after major assistance from a donor has been completed
ECG(Evaluation Cooperation Group)	The probability of continued long-term benefits, and the resilience to risk of the net benefit flows over the intended useful project life.
IFAD (International Fund for Agricultural Development)	The likely continuation of net benefits from a development intervention beyond the phase of external funding support.... the likelihood that actual and anticipated results will be resilient to risks beyond the project's life
IFC(International Finance Corporation)	An assessment of good business performance in relation to financial, economic, environment, and social factors.
OECD-DAC (Organization of Economic Cooperation and Development– Development Assistance Committee).	The continuation of benefits from a development intervention after major development assistance has been completed. The probability of continued long-term benefits. The resilience to risk of the net benefit flows over time.
World Bank	(1990) The ability of a project to maintain an acceptable level of benefit flows through its economic life. (2006) The risk, at the time of evaluation, that development outcomes (or expected outcomes) will not be maintained (or realized).
Brundtland World Commission on Environment and Development	(1987) sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs

Source: Asian Development Bank Independent Evaluation Department

b. Project Sustainability Challenges

It is important for professionals to understand that sustainability is an evolving field and, as a result, the pool of available and feasible solutions is constantly changing. Sustainable transportation systems involve a multitude of challenges, including the significant requirements for land and natural resources to build roadways and to power the vehicles that use them, as well as negative impacts on the human and natural environment from the emissions, congestion, and accidents created by the vehicles operating on those systems [11].

Based on (ADB, 2010; Transportation Research Board of the National Academies, 2005; AusAID) Some of the challenges of transport project sustainability are summarized below as described in [9, 12].

- ❖ Sustainability sometimes has a low priority. Governments, private and international development agencies commonly hold that development planning processes and those associated with lending focus more on approval and implementation of projects, and less on the processes and conditions required to maintain project outputs and outcomes during the rest of the project life. Giving a low priority to the sustainability of projects can result in several substantial consequences: more rapid deterioration of infrastructure and increased maintenance costs, reduction in the level and duration of project benefits, reduced quality of services, reduced access of particular groups to project benefits, and reduced focus on institutional development.
- ❖ Influence on project sustainability has been attributed to different factors. The main factors influencing sustainability at the project level were grouped into four categories [9]: Continued delivery of services and production of benefits, Maintenance of physical infrastructure, Long-term institutional capacity, and Political support.

c. Approaches of Sustainability and Sustainability issues in all Project Phases

Technical, social, economic and environmental challenges have become increasingly complex. These force organizations to generate new ideas, manage change and adopt new ideas. Consequently, the need for sustainability has emerged. Key concepts to successfully integrating sustainability into project development include sustainable actions through all project phases, close interdisciplinary coordination, and appropriate use of sustainability resources. Six steps approach developed [11] to better sustainability approachable and attainable on every project, no matter the size, type, or location. These are:

1. Develop a Sustainability Vision,
2. Identify Project Context,
3. Define Sustainability Goals,
4. Identify Sustainable Solutions,

5. Assess and Select Sustainable Solutions, and
6. Incorporate Solutions.

2.2. Role of Project Manager Skill for the Success of Project Sustainability Management

The concept of project management as a discipline was developed to manage the United State (US) space program in the early 1960s. Project Management differ from other Management Principles into two significant ways as described in [13]:

1. While department managers or managers of other organizational units expect their departments to exist indefinitely, project managers focus on an undertaking with a finite life span.
2. Projects frequently need resources on a temporary basis, whereas permanent organizations try to utilize resources full-time.

If project management differs from other management principles, the skills required to manage a project is also differ from the skill required to manage other organizations. Project manager skill is not as the same as project management skill. This two are not similar and quite differ. Regarding to the skills and expertise, it is stated in [14]:

the skill and expertise that made them stars in their technical fields are mistakenly thought to translate into project management skills. This is not necessarily so.” Project managers are generalists with many skills in their repertoires. They are also problem solvers who wear many hats. Project managers might indeed possess technical skills, but technical skills are not a prerequisite for sound project management skills. Your project team should include a few technical experts, and these are the people on whom the project manager will rely for technical details.

For instance, the sharing of resources frequently leads to conflict and requires skillful negotiation to see that projects get the necessary resources to meet objectives throughout the lifecycle of a project.

The skills required to be a successful project manager consists of communicating with everyone involved in the project, organizational and planning skills, budgeting skills, conflict management skills, leadership skills, team-building and motivating, organizing a project from beginning to end, structuring a plan that will stand up under pressure, getting people to accept the plan and support it, setting measurable project objectives, utilizing available resources, eliminating waste of time and money, measuring project performance, using information systems that respond to project needs, and listening to what others have to say [13, 14].

If the project managers fulfill these skills and apply the skills effectively to the project, the project will achieve its objectives and sustainability issue will be solved easily. This means, a project will meets the needs of the present without compromising the ability of the future generations to meet their needs.

2.3. Project Sustainability Monitoring, Evaluation Framework and Indicators

This time, it is well recognized that the importance of civil infrastructure systems are essential in providing the range of services generally considered necessary to support a nation's socio-economic development and quality of life. Consequently, it is importance to government, business, and the general to the public that these services are sustained over the long term by periodic replenishment of the physical systems that deliver them. Development of infrastructure projects generally receives vast amount of capital investment in any country. Ethiopia is one of the countries which allot mega of capital for its projects. However, one of the critical challenges in the development of physical infrastructure is meeting the growing demand for new infrastructure, while maintaining, upgrading or replacing aging infrastructure. This critical challenges force the countries to the recognition of the importance of ensuring infrastructure sustainability during its life cycle. In do courses, developing project sustainability evaluation framework and indicators for each project is one of the means to assure infrastructure sustainability.

❖ Summary of project sustainability monitoring, evaluation framework and indicators

Factors that affect post completion sustainability in AALRTP

1. Economic Dimension

a. Inception stage – consists of the following indicators and their descriptions

- Supply and demand - The project has evaluated local, regional, national, and even global market supply and demand of current similar products/projects and in the future
- Marketing forecast - The project has predicted market size, pricing, marketing strategies, and marketing targets in its planning stage
- Effects on local economy - The project serves both the local economy and take advantage of the infrastructure in the local economy to generate economic benefits
- Life cycle cost analysis - The analysis done have given more emphasis to total cost for building-up, operating, maintaining, and disposing a construction project over its life
- Capital budget - The project has defined the capital budget to planning and controlling project total cost

b. Design stage – consists of the following indicators and descriptions

- Consideration of life cycle cost - The project has considered the total cost involved in project life cycle, including site formation, construction, operation, maintenance cost and demolition cost
- Project layout - The project has considered the standard dimension in design specifications
- Materials choice - The project has considered the

economy, durability and availability for material selection

c. Construction stage - consists of the following indicators and descriptions

- Consideration of life cycle cost - The project has considered the total cost involved in project life cycle, including site formation, construction, operation, maintenance cost and demolition cost
- Project layout - The project has considered the standard dimension in design specifications
- Materials choice - The project has considered the economy, durability and availability for material selection

d. Construction stage - consists of the following indicators and descriptions

- Loan interests - The project considered given to the interests for the capital cost paid for both a fixed loan and liquid capital
- Materials cost - The project considered the costs for all types of materials such as concrete, lime, steel, timber, bamboo, and brick
- Energy cost - The costs for consuming various types of energy such as electricity, oil, gas, and coal for the project was considered in the construction phase
- Installation cost - Costs for the installation of all kinds of equipment and facilities were considered
- Site security - The project has taken various types of measures for protecting the site safety

e. Operation stage - consists of the following indicators and descriptions

- Balance sheet from project operation - A balance sheet were developed to continuously check with the project cost and time
- Logistics costs - The project has done the logistic costs for materials procurement, stock costs, and transpiration
- Training costs - Training package were developed for improving the quality of human resources of the project

f. Closure (Demolition) stage – consists of the following indicators and descriptions

- Labour cost - Human resources were provided for planning, managing and operating project demolition
- Compensation to project stakeholders - The project has planned a compensating package to those affected parties during closure/demolition process
- Compensation to the polluted environment - Appropriate costs were considered for the compensation made for the damaged environment to the local residents, land, water, and ecosystems during the project
- Land value for redevelopment - The value of the land after closure/demolition for re-development were considered in the project

2. Environmental Dimension

a. Inception stage - consists of the following indicators and their descriptions

- Eco-environmental sensitivity - The irreversible impacts were avoided, as much as possible, on the surroundings from implementing a project
- Noise assessment - Examined potential noise pollution during both project construction and operation stages
- Waste assessment - Examined potential noise pollution during both project construction and operation stages

b. Design stage - consists of the following indicators and descriptions

- Designer - The project were designed by knowledgeable designers of energy savings and environmental issues
- Life cycle design - Effective communications among designers, clients, environmental professionals, and relevant governmental staff to ensure all environmental requirements are incorporated in the design process
- Environmentally conscious design - The project has included all environmental considerations into project design for construction, operation, closure/demolition, recycling, and disposal phases

c. Construction - consists of the following indicators and descriptions

- Land use pollution - The project has utilized the land effectively and the measures taken to avoid land pollution
- Waste generation - The project considered waste produced from project operation in the planning stage
- Health and safety risks - The project ensure on-site health and safety by reducing the number of accidents, providing on- site supervision, and providing training programs to employees
- Structural operations - Consideration being given to the reduction of earthwork and excavation, formwork, reinforcement, concreting and waste treatment during structural operation of the project
- Environmental regulations - Environmental protection law and regulations on construction activities were considered in the project

d. Operation stage - consists of the following indicators and descriptions

- Various energy consumption - Energy consumption on electrical, lighting and other energy appliances were studied thoroughly in the feasibility study
- Environmental consciousness training among employees - The project provided various education and training programs to different levels of employees and stakeholders

e. Closure (Demolition) stage - consists of the following indicators and descriptions

- Demolition plan - Adequate closure/demolition plan on hazard materials and waste reduction or recycle were incorporated in the project
- Demolition control - Supervision and control mechanism were designed in the project on the closure/demolition activities to protect the environment
- Waste classification - Classification of closure/demolition wastes for enabling effective treatment and disposal was done

3. Social Dimension

a. Inception stage - consists of the following indicators and their descriptions

- Conservation of cultural and natural - Avoided negative impacts from project development on any cultural heritage
- Employment - Project implementation provided local employment opportunities
- Infrastructure capacity-building - The project improved local infrastructure capacity, such as drainage, sewage, power, road, and communication, transportation, shopping, education, financing, and medical
- Safety assessment - An assessment was conducted to identify any future safety risks to the public and project users Considerations were given in designing process for emergencies cases

b. Design stage - consists of the following indicators and descriptions

- Safety design - Considerations are given in designing process for emergencies such as fire, earthquake, flood and eco-environmental accidents
- Security consideration - The project Installed security alarm and security screen

c. Construction stage - consists of the following indicators and descriptions

- Direct employment - The project provide working opportunities from implementing the project to the local labour market, including construction workers, professionals, and engineers
- Indirect employment - Employment generated by the up-and-down stream industries and services to construction has seen in the project exhaustively
- Construction safety - Safety measures, facilities, and insurance for working staff has considered in the project
- Improvement of infrastructure - The project provide better drainage, road and electrical systems
- Infrastructure burden - The project has identified the demand for water, road, energy, services and space for implementing the project

d. Operation stage - consists of the following indicators and descriptions

- Direct employment in project operation - The project

considered the costs for employing workers, managers, and professionals

- ◀ Provision of services - The project improved living standard to local communities

e. Closure (Demolition) stage – consists of the following indicators and descriptions

- ◀ Land for new development - The project considered the land upon the completion of project demolition to enable implementing new projects according to the demands of local community
- ◀ Job opportunity - Provision of jobs during project closure/demolition for site work, transportation and disposal were considered in the project
- ◀ Communication to the public - Promotion on the public awareness of the project demolition and the possible impacts to the public were implemented

4. Technical Dimension

Performance, reliability, durability, flexibility and adaptability, resilience to recover and vulnerability to failure are indicators of the technical dimension which are applicable in all project management lifecycle

5. Coordination Dimension

The following indicators of the coordination dimension are applicable in all project management lifecycle

- ◀ Horizontal and/or vertical integration - There is horizontal and/or vertical integration between our projects and other service rendering organizations' projects in sustaining infrastructure projects.
- ◀ Lack of coordination challenges - There are challenges our organization faced due to lack of coordination between infrastructure projects.
- ◀ Action required minimizing the challenges - The challenges we faced can be minimized or eliminated if certain follow up is made available from project owners or agencies of different projects?
- ◀ Agency responsible to coordinate infrastructure projects - There is a legal entity that is responsible to coordinate infrastructure projects in A.A. City administration?
- ◀ Contribution of the coordinator - The body that is responsible to coordinate infrastructure projects contributed a lot in sustaining infrastructure projects of Addis Ababa.
- ◀ The importance of coordination - There are a number of issues services rendering agencies/organizations should coordinate to sustain infrastructure projects constructed in Addis Ababa.
- ◀ Institutional collaboration for sustainable infrastructure - There is institutional collaboration /coordination /dialogue/ experience sharing between agencies in sustaining infrastructure projects?

6. Communication Dimension

The following indicators of the communication dimension are applicable in all project management lifecycle

- ◀ Stakeholder communication requirements - The project defined the communication requirements for the project and how information will be distributed
- ◀ Communication constraints - Communications management constraints has been identified clearly in the project
- ◀ Communication methods and technologies - Based on the defined stakeholders communication requirements, the methods and technologies were properly set in the project
- ◀ Communications matrix - Workable Communication matrix was designed for the project
- ◀ Communication flowchart - The communication flowchart was developed for the project

Source: [15] [16] [17] [18]

The fifth and the sixth dimension are incorporated in the paper by the researcher since they have adverse impact on projects in the current Ethiopia context.

2.4. The Role of Railway Development Strategy for Socio Economic Development

The economic contribution of transport interventions and transport policy can be assessed from the perspectives of micro-economic, macro-economic, investment or employment, and the spatial patterns of economic activity; and effects on aggregate economic welfare (that is, the sum of consumer and producer surplus), which is the focus of cost-benefit analysis, as applied to transport policies or projects.

Railway as one of the transport means, its intervention to the national socio-economic is not different from this. This intervention and role of the transport can be achieved through a well designed strategic development plan. Railway project is not an overtime job. It takes time to implement it. Railway project impact on the socio economic development of any country as well as the time it requires to implement described as follows [19]:

Railway projects involve huge capital investment, and it typically takes eight to ten years for a railway project to take shape from formulation of ideas, conceptual planning, consultation with stakeholders, detailed design, to actual construction and completion. As they have profound impact on people's livelihood and socio-economic development, we have to be forward-looking and make timely plans for our railway development in future. In planning future railways, transport demand and cost-effectiveness are important considerations, as are the wider socio-economic benefits they will bring about.

This statement clearly explained the need for thorough railway strategy to achieve myriad benefits in the socio-economic development of any country.

2.5. Railway Project Sustainability Management Priority Areas

Railway project sustainability management priorities are those issues that are of the highest importance for both to the

business and the stakeholders. Eight sustainability priorities of railway project sustainability management are [20]: resource management, customer service, health and safety, environmental management, supply chain sustainability, sustained and dynamic engagement, societal development and climate change

2.6. Conceptual Framework of the Paper

Sustainability, in the context of development projects, can be defined as the continuation of positive project outcomes after the project activities are completed and assistance (like allocation of budget) from the project has ceased.

Civil infrastructures are inherently interconnected and interdependent. Therefore, failures in one infrastructure system can cause disruptions in others that could ultimately spread to still other systems. Interdependent failure effects occur when an infrastructure disruption spreads beyond itself to cause appreciable impact on other infrastructures, which in turn causes more effects on still other infrastructures. The potential for failures in one infrastructure system to cause disruptions in others that could ultimately cascade to still other systems with unanticipated consequences is very real. These are the main points that force Railway Corporation should communicate and coordinate with other organization engaged in civil infrastructures like Road Authority, Water & Sewerage system authority, Ethio Telecom, Ethiopian Power & Electricity Corporation, etc. The conceptual framework of this paper consists of six major components and each component consists of various sub components as it is described here under.

1. Environmental Sustainability:

Environmental sustainability is the rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued indefinitely. If they cannot be continued indefinitely then they are not sustainable.

“...The projects’ impact on the environment has generally been found to be acceptable after the implementation of the appropriate mitigation measures, which in some cases were considerable. In some projects adverse local environmental impacts were identified but found acceptable, given the national importance of the projects. Other projects were subject to complex negotiations in areas with sensitive environments (such as vineyards) but in the end acceptable solutions were found. In one case, significant environmental damage occurred during implementation which polluted the surrounding groundwater level. The ensuing mitigation and prevention measures have resulted in an implementation delay, which is currently estimated at 7-8 years [21]

Three environmental sustainability objectives as stated in [22]:

- a. to minimize the use of resources
- b. to minimize pollution
- c. to protect biodiversity and the natural environment

Environmental sustainability dimension consists of various sub components used as indicator of environmental sustainability which are listed under 2.3.

2. Social Sustainability: is a positive condition within communities, and a process within communities that can achieve that condition. Six social sustainability objectives as stated in [22]: to adhere to ethical standards during the development process, to provide adequate local services and facilities to serve the development, to provide basic social needs to meet local needs, to integrate the development within the locality, to provide high quality, live-able developments and to conserve local culture and heritage, if appropriate.

Social sustainability dimension consists of various sub components used as indicator of social sustainability which are listed under 2.3.

3. Economic Sustainability: economic sustainability concerns mainly the profitability of the invested capital, cost efficiency, financing over time and flexibility

Economic sustainability from corporate and public investment project has different meaning [23]. From a corporate perspective, the profitability of the invested capital can be measured by comparing costs and income of the investment over its (intended) lifespan, in order to judge whether or not the profitability is positive and higher than that for alternative investments.

From the perspective of a public investment project, the measure of economic sustainability alters. Public investment projects – such as infrastructure projects or defense equipment procurements – are often characterized by being public benefits, and organizing payment by use is often neither possible nor desirable. Therefore, financing such an investment project often needs organizing forced financing via taxes.

Three economic sustainability objectives as described in [22]: to enable businesses to be efficient and competitive, to support local economic diversity and to provide employment opportunities

Economic sustainability dimension consists of various sub components used as indicator of economic sustainability which are listed under section 2.3

4. Technical Sustainability: To achieve a sustainable design, all the above three sustainability pillars (environmental, economic, and social) must support and be supported by the other like technical performance sustainability.

Technical sustainability dimension consists of various sub components used as indicator of technical sustainability which are listed under 2.3

5. Coordination Sustainability:

Coordination can be seen as a process of managing resources in an organized manner so that a higher degree of operational efficiency can be achieved for a given project. Construction can be viewed as a process of putting together all the materials in an orderly and timely manner by utilizing relevant resources to complete a structure as per designed specifications and quality standards. Civil construction is adding infrastructure such as roads, railways, airports, harbors, dams, mines and golf courses to the environment, and industrial construction deals with large projects such as

pharmaceutical, petroleum, chemical, power generation and manufacturing complexes [24].

The process of construction, depending on the complexity of the structure, requires a high level of vertical and horizontal coordination among all the professionals and organizations from design office to the construction site until the project is completed.

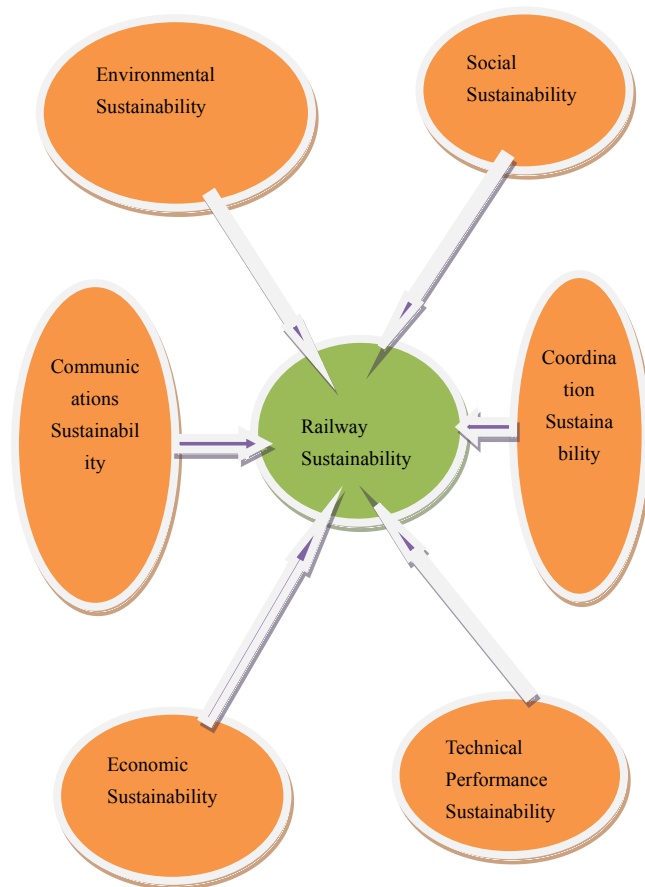


Figure 1.1. Conceptual Framework for Railway Project Sustainability Management

6. Communication Sustainability

Without effective communication mechanism among the project team members and stakeholders, aspiring of achieving sustainability in any project is unthinkable. The purpose of the communications sustainability is to define the communication requirements for the project and how information will be distributed. The communications system of the project defines: What information will be communicated, How the information will be communicated, When information will be distributed, Who is responsible for communicating project information, Communication requirements for all project stakeholders, What resources the project allocates for communication, How any sensitive or confidential information is communicated and who must authorize this, How changes in communication or the communication process are managed, The flow of project communications, Any standard templates, formats, or documents the project must use for communicating, Any constraints, internal or external, which affect project

communications, An escalation process for resolving any communication-based conflicts or issues, etc.

3. Research Methods & Methodology

In this topic the paper tries to develop the methods which are proposed to be used. In this chapter, the following sub topics are tried to covered: - overview of study areas to make the study areas more brief, the research approach, source of data to indicate from where the data for the research topic will be collected, the data collections section was used to describe how the data were collected and utilized according to the procedures which were discussed in the methods part, target Population is the overall population in the research topic, sampling technique that indicates how much sample of data can be taken from the target population , and the data analysis section: in this data analysis section the paper provides a general framework to deal with decisions without making any assumptions about the methods, criteria used and alternatives to choose from. So, overview of the study area, the research approach, source of data, data collections, target Population, sampling technique, and, data analysis were discussed in their respective sub topics.

3.1. Overview of the Study Area

The AALRTP is located in Addis Ababa, the capital of Ethiopia, which was the location of the project office around Ayat, now the project is at the phase of closure, and the Operation Service head office is located around Saris-Kaliti. The population of Addis Ababa is 3,384,569 according to the 2007 population census with annual growth rate of 3.8% (Wikipedia). Based on this premises, the current total population size of Addis Ababa is more than 4.5 million which take 5% of the total population of the country - Ethiopia. To effectively solve the problem of urban transportation, especially that of the downtown area of the city, the government of Ethiopia decides to build a light rail in the city of Addis Ababa. Currently the project has implemented two lines, the east-west (E-W) line and the south-north (N-S) line. According to Ethiopian Railways Corporation (2014), the total length of AALRTP is 34.25 km (N-S line 16.9 km and E-W line 17.35 km) which has the capacity of transporting 60,000 passengers per hour and the design speed is 80 km per hour. Forty four Light rail transit stations are in placed for both E-W & N-S route projects(twenty two stations for each) , five of which are shared stations. Average interval between two adjacent stations is around 850 meters. The longest interval is around 1300 meters and the shortest interval is around 400 meters

3.2. Research Approach

There are three type of research approach: qualitative, quantitative, and mixed method approach. To explore and describe post completion sustainability of railway project, qualitative research approach was applied in this research paper. This means data will be collected through observation,

interview and document analysis to know post completion sustainability of AALRTP. This is because of the following core reasons:

1. Very few professional were aware in details about AALRTP from the Head Quarter, Ethiopian Railway Corporation
2. Interviews were mad with the employees who have participated actively in the AALRTP from the Head Quarter, Project Office and AALRT Service Office.

3.3. Research Design

The research design can be defined as a plan, structure and strategy of a research to find out alternative tools to solve the problems and to minimize the variances [25].

Research design of a study can vary based on the nature of the problem and also type of research.

The topic of this study is concerned about the Post Completion Sustainability of Railway projects in Ethiopia: The case of Addis Ababa Light Railway Transit Project. The study explores and describes the AALRTP with specific reference to post completion sustainability management. To explore and describe whether sustainability concept is applied at ERC properly, using casual, case study analysis, hypothesis testing, explanatory, cross-sectional, longitudinal and correlation research types are not appropriate. It is not the intention of the study to get insights too rather to describe characteristics of a population or phenomenon being studied. The target of the study is not to answer questions about how/when/why the characteristics occurred. Rather to address the "what" question (What are the characteristics of the population or situation being studied?). The research designs that can use to describe the situation or population are usually some kind of categorical scheme also known as descriptive categories.

Owing to the above facts, the researcher applied descriptive research type. Under descriptive research, structured interview, observational approach, and document analysis were employed since it is qualitative research type.

3.4. Target Population of Sampling

The target population of the study is the Ethiopian Railway Corporation, AALRTP, and AALRT Service Office Employees as a whole. Even if those who are employees of the offices are the target population, due to the nature of the paper, the respondents are engineers who were involved in some of the project life cycle or in all of the project life cycle.

3.5. Data Collection Methods

Both primary and secondary sources of data were used to collect the necessary data. With regard to primary source of data, to get clear and unambiguous information about the post completion sustainability of railway project at AALRTP, structured interview, observation and document analysis were conducted. The researcher also used secondary source of data like project documents (strategic plan of Ethiopian Railway Project, feasibility study of AALRTP, Conceptual

documents of AALRTP), online sources, articles, books, reports, pamphlet, profiles, etc so as to get the necessary information.

3.6. Sampling Technique

Purposive sampling was used to select the interviewees. This sampling technique was helped the researcher to select those engineers who were involved in most of the project life cycle and have thorough knowledge and skill about the technical aspect of the project and about the project sustainability. As it is stated in [26], purposive sampling is a useful sampling method which allows a researcher to get information from a sample of the population that one thinks knows most about the subject matter. The researcher used purposive sampling techniques because of the following reasons:

1. Since sustainability is not a matter of one phase implementation, rather in all project life cycle phases, the research need respondents who were involved in all project phases, if possible, or at least in some of the project phases
2. Since sustainability and factors that affect sustainability is too technical, engineers who are engaged in the project are the only target people
3. AALRTP is at the closure/demolishing phase. Due to this reason, the contracts for most of the employees were expired.
4. AALRT Service Office (now the Head Quarter for AALRT) is established recently and most of the employees are new for the organization.
5. Since very few employees are involved in the AALRTP from Ethiopian Railway Corporation.

To consider the Ethiopian Railway Corporation Head Office Employees, Addis Ababa Light Rail Transit Project Office Employees, and Addis Ababa Light Rail Transit Service Office Employees, the researcher was employed stratified sampling by taking each of them as a stratum. Then, informants were drawn from each stratum by employing purposive sampling techniques. Based on this, seven employees were interviewed. Out of which, four employees were from the project office, two from Ethiopian Railway Corporation and one from AALRT Service Office.

3.7. Data Processing and Analysis Method

Data processing is the collection of and manipulation of items of data to produce meaningful information. In this sense, in the data processing of this paper the following activities were made: validating, sorting, summarize, aggregating, analysis, reporting and classification. These activities help the researcher to reduce the anomalies even though it is not possible to eliminate at all.

Analysis of data is a process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making. This means data analysis is the further transformation of processed data to look the impact of

sustainability factors on post completion sustainability of the project.

To summarize, the method of data analysis was mainly descriptive type and the analysis was handled in a way that each issue included in the study could be addressed and qualitative descriptive was applied. Data analysis of the sample was made by the researcher with the help of checklist for document analysis as explained in [27].

3.8. Research Limitations

Even though incorporating all stakeholders (contractors, end users, consultants, etc) were contributed to the research result reliability, collecting the necessary information through data collection mechanism from these stakeholders was very challenged and difficult within the researcher time frame and financial capacity. Due to this reason, the researcher only focused on ERC employees and AALRT project team members.

3.9. Research Ethics

In this study, the researcher distributes the cooperation letter, that describe the title of the paper and its purpose, for the Head Quarter of Ethiopian Railway Corporation, AALRTP office, and AALRT Service Office now a Head Office for AALRT. In addition to this, all respondents in this paper were appropriately informed about the purpose of the research and the contribution of their genuine response before conducting an interview session.

4. Data Presentation, Data Analysis and Interpretation

4.1. Interview Analysis

In order to assess the existing circumstances of the organization with regard to post completion sustainability, interview was conducted to the Ethiopian Railway Corporation, AALRTP, and AALRT Service Office employees and the response is analyzed and presented under 4.1.4.

4.1.1. Sample and Procedure

The interviews selection process from the target population was discussed briefly with strong justification in chapter three under section 3.6 (Sampling Technique). Even if the sampling technique was purposive, to avoid sample bias, the researcher tried to select the interviewees with the help of ERC higher officials. Seven interviewees were selected (four from the project Office, two from ERC head Quarter, and one from AALRT Service Office) who have involved in two or more project management lifecycle of AALRTP. The sample consists of General Manager, Consultants, Team leaders, and Experts/Officers. The interview questions were distributed for each interviewee before five days of the actual interview was conducted in order to give sufficient time for them. The interviewees were

assured about the confidentiality and purpose of the research, how the expression of their real thoughts and feeling is highly important for the study before and after the interviews session were conducted.

4.1.2. Interview Protocol

The interview questions consisted of twelve questions that shape the interview session period. Research statements of the problem, objectives of the study and literature review chapter gave the ground to design and develop the interview questions for the researcher. As explained above, the interview questions were distributed for each interviewee to create awareness and to make the interview participant more active during the interview session.

4.1.3. Analysis Method

Several scholars proposed several approaches for the analysis of qualitative data [28, 29, 25]. The approach of these scholars for the analysis of the interview was applied. Data analysis incorporate a process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making. The important issues raised by all interviewees during the interview session are presented in this study. To maintain and protect the confidentiality of the interview respondents, the summary and description of the interview result were also given fictitious name from interviewee 1 through interviewee 7.

4.1.4. Analysis Result and Findings

The key points which are more related and vital to the study topic are presented. Due to professional ethics and to maintain the reliability & validity of the study, all the information obtained during the interview sessions were not incorporated here.

a. Sustainability Management Plan

In connection to the sustainability management plan, it is possible to conclude that, if sustainability management plan is not properly done for each project management lifecycle (inception, planning, design, construction, and operation stage), the profound positive impact of the project on the society's livelihood and socio-economic development is not as anticipated.

Regarding to the sustainability management plan in connection to AALRTP, the following points are summarized from the interview sessions.

◀ For the question "is there any documents regarding to sustainability management plan?" Concerning to this question, out of the seven interviewees, six interviewees (interviewee 1, 2, 3, 4, 5 and 6) stressed that there is no document regarding to sustainability management plan for AALRTP. Interviewee 7 assured the availability of the document. However, the respondent further explain "sustainability management plan means the feasibility study of the project and how a government will initiate such a huge investment project without sustainability management plan

or feasibility study of the project?” This indicated the perception of the ERC employees and AALRTP team members about project sustainability management. This assured the researcher that there are no equal understandings about sustainability among the respondents.

Sustainability management plan is not as simple as one document. It is everything for the post completion sustainability of the project. It should contain the sustainability factors at inception, planning, design, construction and operation stage of the project. Excluding sustainability management plan from the project means building sky rocketing building without a blueprint.

◀ For the question “do you think that sustainability infrastructure projects contribute to economic, social, and environmental improvement of a country? How?” Regarding to this question, all respondents replied yes! Any infrastructure project is designed and implemented to be sustainable and have a huge share in improving the socio-economic development of the country. For instance, in the case of AALRTP, since Addis Ababa is the capital city of Ethiopia and of course Africa, it has a political impact. If the project fails, the image of the country will be in question. The interviewees believed the sustainable infrastructure project has the following benefits: GDP will increase, Government will collect tax from the area, Security prevail, Society living standard will be improved, Attract foreign investors, Play a great role in changing the country image, Any sustainable infrastructure project definitely will grant the economic, social and environmental improvement of a country, Sustainable infrastructure project will transfer primitive society to modern society since infrastructure play a great role and used as a bridge between primitive and modern society, Economic investment increase, etc

As we can see the interviewee’s response above, sustainability infrastructure will bring immense advantages for the socio-economic development of a given country. The critical question here is “are sustainability is part of the projects in general and in AALRTP specific?” The answer for this is very simple and stated explicitly by the respondents in the first question. This is the critical sign for the projects which are ongoing and to be launched in the future.

b. Factors that affect sustainability of AALRTP

Sustainability of the any project can be affected by different factors as it is stated in the literature review part. As any other projects, the sustainability of AALRTP may also be affected by different factors. To pinpoint some of the factors that affect the sustainability of AALRTP, a few interview questions were drawn and generalized as follows.

◀ For the question “what are the factors that affects the continuation of the flow of benefits from railway development projects after completion?” The factors that affect the continuation of the flow of benefits of the project can vary project to project. According to the interviewees response, the factors that affect the continuation of the benefits of AALRTP are: capacity problem in related to

human power and running the project, the technology that we import, economic capacity (the muscles for the project), other infrastructure development, awareness, construction quality, staff management and safety & security.

Most of the factors that were identified by the respondents were not thoroughly investigated at the feasibility study time. For instance, interviewee 3 explained that the shortage of power was indentified when AALRTP was started operation. The trains were stand when they faced power shortage and a corrective action were made soon. Another example is, AALRT Service Office doesn’t has any document at this time like sustainability document, design document, construction document, operation document and etc.

◀ For the question “What major risks to sustainability were identified at appraisal, design and during implementation, and how were they mitigated or are planned to be mitigated after completion?” The answer for this question is classified into three. These are:

- ✓ Four respondents (interviewee 3, 4, 5 and 6) prefer not to respond on this, they suggest that “it is better to see if there is any document at the head quarter about these issues”.
- ✓ Two respondents (interviewee 1 and 2) assured that “sustainability risks were not identified and documented for all stages of project management life cycle”
- ✓ One respondent (interviewee 7) emphasized that “major risks of sustainability were identified well. For instance, level cross (red zone) and its mitigation are to slow down the train speed and to make available a traffic police at each level cross.”

◀ For the question “What are the implications of ERC’s approach to ensuring the sustainability of AALRTP? And what and how should ERC do things differently to enhance post-completion sustainability of this project?” Sustainability must be the main focus attention of the project. The response of the interviewees to ERC approaches to ensure the sustainability of AALRTP and thing that ERC did differently to enhance post completion sustainability of the project is summarized as follows:

- ✓ Opening project office, avail the necessary manpower for the project office, the project was designed and implemented by adopting Chinese class two standards, you are required to learn from 120 books which is brought by the contractor, to assure the sustainability of AALRTP, ERC is developing a proposal called “Transit Oriented Development (TOD)”. TOD consists of Green Oriented Plan (GOP) which enable the office to generate money from advertising using the trains screen board and Pedestrians Oriented Plan (POP) which focused on constructing buildings around the stations and using the stations for advertisements. This will help AALRT Service Office to generate money and have the economic power to lead the system.

Since there is no sustainability management plan for AALRTP, risks of sustainability is not expected to be identified at each project life cycle well. The document analysis and observation result is also assured this.

c. Project life cycle and sustainability at AALRTP

Factors affecting the sustainability performance of a construction project are different at various stages across the project life cycle as it is stated clearly in the literature review part. In line with this concept, factors affecting sustainability performance of a construction project can be examined in six main categories namely economic, social, environmental, technical performance, coordination and communication factors/dimensions in each project life cycle. The responses of the interviewees are summarized below:

❖ For the question “have the project considered the economic, social, environmental, technical performance, coordination and communication sustainability? If the answer is yes, is it for each project life cycle like inception, design, construction, operation and closing/demolishing phase?” The respondents response with this regard is categorized into three and revealed as follows”

- ✓ Four respondents (interviewee 3, 4,5 and 6) described as if they have not a clear idea about it. If the project implementers are not aware of this who will know about it? This is the main question of the researcher and tried to get the answer from the document analysis and observation.
- ✓ The responses of two respondents (interviewee 1 and 2) indicated that project was not considered the sustainability factors at each project life cycle in AALRTP.
- ✓ One respondent (interviewee 7) stressed that “since the project contract type is Engineering, Procurement, and Construction (EPC) type planning, design, construction, implementation, and closing phase is at the hand of the contractor”. So it is hard to know whether each factor is considered at each project life cycle or not.

"Engineering, Procurement, and Construction" (EPC) is a particular form of contracting arrangement used in some industries where the EPC Contractor is made responsible for all the activities from design, procurement, construction, to commissioning and handover of the project to the End-User or Owner [30]. Currently, AALRTP is at the stage of closing/demolishing, the researcher investigated that the contractor is transferring all the design, construction and implantation document. A single contractor designs the project and implemented by the same contractor. It is very hard to rely on the single contractor on such project that required huge investment as big as 475 million dollars. How the project was design, constructed, implemented is still a secret agenda for most of the employees and will remain as secret since the project is closed. That may be the main reason for the interviewees to respond poorly about sustainability and related issues raised before.

d. Stakeholders management and Coordination Sustainability

For the question “Who are the stakeholders /organizations you need to collaborate with and make coordination in sustaining the infrastructure projects constructed by your organization?” all the respondents identified potential stakeholders for AALRTP. Some of the stakeholders identified by the interviewees are: ERC, Contractors, Consultants, ERC Board, Ministries of Ethiopia, Ethiopian Security Forces, Ethiopian Immigration and Nationality Affairs, Addis Ababa (AA) City Administration, AA Road Authority, AA Water Authority, Ethiopian Electric Power Corporation, Ethiopian Telecom, Kefile Ketema Offices, etc.

Although the process of construction, depending on the complexity of the structure, requires a high level of vertical and horizontal coordination among all the professionals and organizations from design office to the construction site until the project is completed, AALRTP doesn't exploit the advantage of vertical and horizontal coordination. From the interviewees responses, the coordination among the Utility Services Providers (Road Authority, Ethiopian Electric Power Corporation, Ethio-telecom, Water and Sewerage Authority and Ethiopian Railway Corporation) too poor to understand and make use of coordination as a process of managing resources in an organized manner so that a higher degree of operational efficiency can be achieved for a given project.

e. Communication with the stakeholder

The purpose of the Communications Management Plan is to define the communication requirements for the project and how information will be distributed. The Project Manager should take a proactive role in ensuring effective communications in any project. The project manager is responsible for managing all proposed and approved changes to the communications management plan [31]. If this is certainly true, does AALRTP incorporated the communication management plan to communicate the stakeholders for all stage of project management lifecycle? This was discovered using the following interview question.

❖ For the question “how do you communicate the stakeholders?” All respondents of the interview assured that communication is a critical factor in any project. AALRTP communicate the stakeholders either written letters and/or through telephone conversation.

From the responses, document analysis and observation, it is possible to generalize that AALRTP doesn't identified the communications management constraints, stakeholder communication requirements, communication methods & technologies, communications matrix and communication flowchart.

4.2. Document Analysis

Document analysis is a form of qualitative research in which documents are interpreted by the researcher to give

meaning around an assessment topic. Six criteria were used by the researcher that covers the knowledge utilization of documents as stated in [27]:

1. The form of the document: reports, documentations, project descriptions, applications, invitations, newsletter, homepage, movies, and etc
2. The physical characteristics of the document (How does the document look like? Material? Condition?)
3. The internal characteristics of the document / the content in the document.
4. The aim of the document: What is the aim of the document? What is the message?
5. How near or far away is the document from the content? Does the document really represent the intended content?
6. Where does the document come from? Who wrote the document? Who takes responsibility for it?

Having this in mind, how document analysis will be done, the researcher tried to identify types of documents which may help in doing this research. In doing this, feasibility study document, content document, planning, design, construction, operation/implementation and closing/demolishing documents of AALRTP were highly needed. However, the researcher had got only the feasibility study, content and strategic plan documents. The rest documents were neither at ERC nor at the Project Office till this time. From the observation, the researcher identified the design, construction and the implementation documents are at the hand of the contractor in view of the fact that the contract type is "Engineering, Procurement, and Construction" (EPC). The contractor is at the stage of transferring/delivering the documents since the project is at closing stage.

Having the necessary documents from the respective offices, the researcher came up with the checklists that enabled to assess post completion sustainability of AALRTP from the documents. The checklists contain six major factors and sixty nine indicators (sub factors) with brief description for each indicator (sub factors) as it is described briefly under 2.3.

Using the six dimensions and sixty nine sub factors, the researcher tried to analyze the document as follows:

4.2.1. Economic Dimension

In the economic dimension, there are twenty indicators (sub factors) in all project life cycle with a brief description. It is in this premise, the researcher tried to see the post completion sustainability of AALRTP.

In the feasibility study document, Cost-Benefit analysis report was prepared by the Ethiopian Railways Corporation (ERC) for investment decision on the AALRTP namely the East-West and North-South Light Rail Transit System.

... The Cost-Benefit analysis is intended to provide a methodology for prioritizing Addis Ababa LRT project in terms of financial and economic viability. A simplified Analysis model has been set up using EXCEL spreadsheet. This evaluation is however based on a number of

assumptions that need to be refined and verified for each individual case. As per the preliminary analysis, the AA-LRT is estimated to be economically feasible in order to decide for project start up [32].

In addition to this, the feasibility study tried to explain the project cash flow analysis by separating into three parts by considering equity 21%, local loan 49% and foreign loan 30%. In addition to the 21% equity for the project cost, there are cost to be covered by equity. These include engineering cost, loan facility cost (interest during construction, upfront fees, and legal & out-of-pocket fees), compensation cost, land lease cost, and etc...

The price of the train ticket was also got a decision based on the result of Cost-Benefit analysis as shown in the following table.

Table 1.2. Cost Benefit analysis summary [32] [33]

Item	Scenario-1	Scenario-2	Scenario-3	Scenario-4 without shadow benefit
Ticket fare (ETB/PK)	0.48	0.48	0.42	0.48
NPV (\$ million)	26.12	68.51	-2.02	27.27
IRR (%)	10.66%	11.70%	9.95%	10.69%
Average Speed (Km/h)	20	21.6	21.6	21.6

The above scenarios were illustrated graphically to indicate the repayment period in the year is shown below (ERC, 2009).

Out of those alternatives, the operating ticket fare was envisioned to be applicable for different distance defined in the route. Based on one kilometer (1km) distance from station to next station movement, the base fare in Ethiopian Birr per passenger kilometer (ETB/PK) was estimated for longest distance category as tabulated in the following way (ERC, 2009).

Table 1.3. Base Fare [32] [33]

Item	ETB/PK	USD/Pk
Base Fare amount	0.48	0.04

From figure 1.2 Repayment period in the year [32, 33] and table 1.3 Base Fare [32, 33], AALRTP was economically profitable. However, the strategic plan of ERC which run from 2003 -2007, state that the ERC used Porter's five forces analysis framework that attempts to analyze the level of competition within an industry and business strategy development which is accepted and implemented by most of the industries. The five Porter's forces analysis used by ERC is [32, 33] threat of new entrants, threat of substitute products or services, bargaining power of customers (buyers), bargaining power of suppliers and intensity of competitive rivalry.

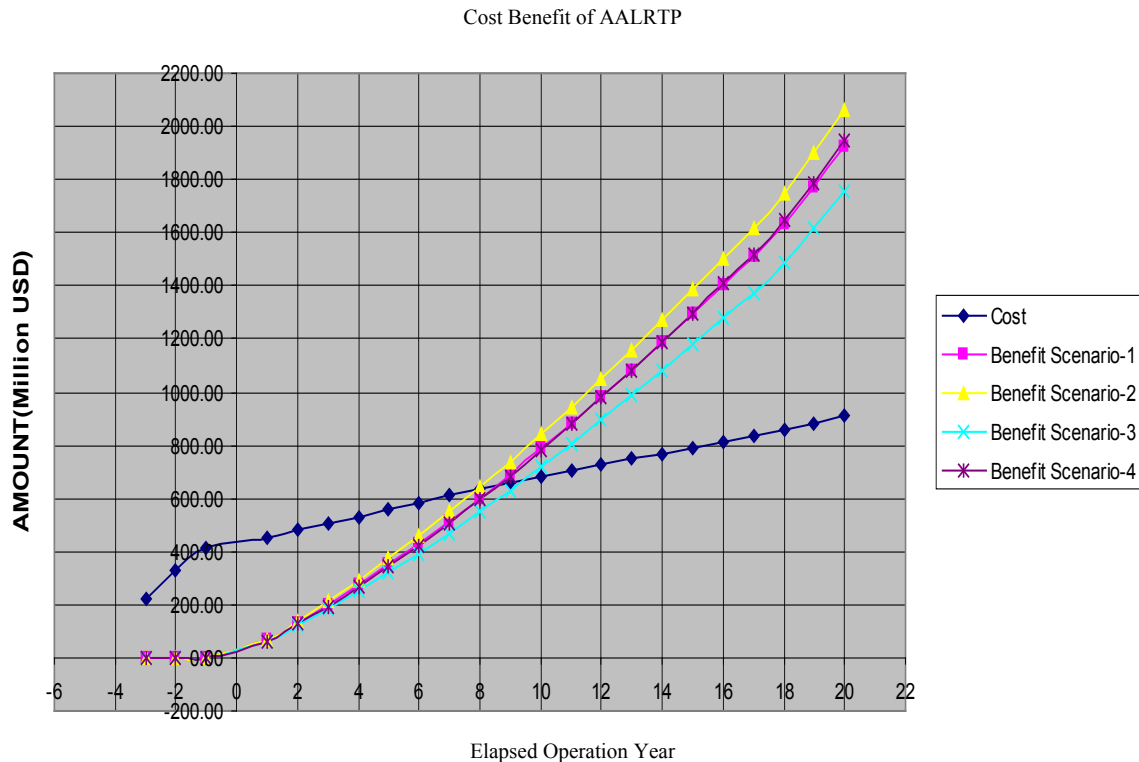


Figure 1.2. Repayment period in the year [32] [33]

The analysis result of this document showed that (see Appendix: B):

Regarding to mass transport:

- ❖ Based on the current society demand, the mass transport system was not expected to be profitable. However, in long distance and in the tourist corridor may be profitable.

Regarding to cargo transport:

- ❖ The current development stage of a country, Ethiopia, Ethio-Djibouti line (Import & export) will be profitable.
- ❖ The other corridors profitability will be assessed based on the research study results which will be done in the future.

The feasibility study and strategic plan 2003 -2007 documents contradict each other. The feasibility study tried to show the economic profitability of AALRTP, on the other hand the Strategic Plan which runs 2003-2007 state that mass transport was not profitable. This indicated that, each document was produced, may be, by different groups or parties and they didn't have a common goal and understanding about documents. This is a big crisis for the organization if it will continue in similar way for other projects too.

Even if both the project documents tried to assess the economic feasibility of AALRTP, the documents focused on six indicators/sub factors (marketing forecast, capital budget, loan interests, various energy consumption, and Land use pollution) of post completion sustainability out of the twenty indicators (sub factors). This by itself will have a negative

impact on the post completion sustainability of AALRTP.

4.2.2. Social Dimension

In the social dimension, there are sixteen indicators (sub factors) in all project life cycle with a brief description. It is in this premise, the researcher tried to see the post completion sustainability of AALRTP.

In the Strategic Plan 2003-2007 document, the social dimension was not thoroughly investigated. Out of those sixteen indicators, listed above, the Strategic Plan 2003-2007 only focused on four of them (which is concerned about employment opportunities in all project life cycle) in a general way rather to treat the employment opportunities at each project life cycle.

In the Feasibility Study documents, the social dimension was treated using one page negative social impacts of AALRTP – matrix.

In general, the negative social impacts of AALRTP – matrix is a good summary that identified fourteen possible negative impacts in regard to social dimension with respect to their consequences, mitigation measures and responsible bodies / agents. The negative impacts consists of displacement, loss of properties and business, lack of land for re-settlers, damage of cultural heritage, compensation delays, health cases and accidents, pollution of water/air/noise/dust smoke and smell spilling of oil, conflicts between host and displaced people, lack of consultation and disclosure, disruption of services, blasting and cracking, indigenous/traditional people impacts, and induced impacts (cumulative).

However, the negative social impact of AALRTP – matrix

was not treated based of project life cycle rather in a general form for the project. So, it is very difficult to identify which negative impact will be treated at which project life cycle. Moreover, it is also difficult to allot time and budget for each project life cycle and to monitor & evaluate at the end of each project life cycle. If there is no monitoring and evaluation report on time, it is hard to take a corrective action if there is a deviation. The consequence of this will lead the project beyond its schedule, budget and may compromise the quality issue which will generate dissatisfaction among the stakeholders.

4.2.3. Environmental Dimension

Information on the existing state of the AALRTP and the possible and predictable impacts on the immediate environment which may arise due to the scale of project were investigated in the feasibility study document. The feasibility study document contains a description of possible influences (positive and negative) on the environment condition and refers to activities which may help to reduce the environmental impact even though it was not treated under each project life cycle.

The document describes the direct and indirect positive and negative influences which could occur as a result of project realization. The general influence on environmental and social-economical conditions was considered.

The environment dimension of AALRTP included four main components concerning resources and values [32] [33];

1. Physical recourses;
2. Ecological recourses;
3. Economics and human recourse; and
4. Evaluation of living standard.

Under physical resources, the feasibility tried to assess air and surface water. The study identified the negative impact on the air quality during construction related to the heavier traffic and consequently greater pollution with exhaust gases and dust, especially due to the excavation works in the depot. The study also tried to state the mitigated method of the impacts through the application of standard technologies, these included:

- a. Regular washing of the equipment
- b. Covering of the materials subject to dispersion (at storages or during transportation, and also in dumping areas)
- c. Watering and cleaning of the dirty streets polluted by construction equipment.

The air pollution was assessed in the study by classifying the project in to two phases: construction period and operation & maintenance period. Under construction period, the study identified the direct and indirect effect of the project. On the other hand, under operation & maintenance period the study stated that after construction of the AALRTP, the quality of the air will improve due to the anticipated major modal shift from cars, taxis and buses to the LRT system. Consequently the emissions of polluting substances in the air from petrol and diesel vehicles transport

will decrease substantially.

The surface water assessment was treated in the study by separating into two periods: construction period and operation & maintenance period.

It is believed that during the construction period, disturbance of the ground could occur due to the construction of the stations and structures and impact on the watercourses. Some ecological consequences of disturbing the water courses were to be expected due to the high probability of construction occurring in the dry season and the low rate of biophysical sensitivity. However, the study leaves this issue open to treat the possible damage to the resources due to the construction works to be determined in the next design and Environmental Phase of the project. But, Design and Environmental Phase document was not yet produced and documented under the Project Office.

In general, the feasibility study stated that due to construction and operation of the AALRTP, the influence on surface water will have a minor negative effect during the construction period, due to the impact of dust and excavated materials during the construction of stations, viaducts and pedestrian elevated crossings and zero impact during the LRT operations period.

Under ecological resources, the feasibility study tried to assess vegetation and soils. As identified in the study of AALRTP, the project has some initial negative impact during the construction period due to the initial removal and/or relocation of the trees and no impact during the operations period. In addition to these, the study identified AALRTP influence on the soil. The influence of the project on the soil was minor during the construction period, due to the disturbance and removal of the soil in the corridor of construction and not significant during operations.

The study also identified that project had an influence on land use during the construction and operating of the AALRTP. As it was identified in the study, the influence of the project on land use was minor during the construction period, due to the temporary use of open plots, which could bring short-term consequences such as constraints to local industries and positive as enforcement of planned growth will have a positive effect on efficient land use in the city.

In the construction and operation period of the AALRTP, the impact on the level of noise was identified in the study. The study stated that project had negative effect during construction period due to the construction equipment in operation and heavier traffic caused by the materials transportation and reduced road traffic capacity and a positive effect due to the significant replacement of motor traffic by the AALRTP system during the operation period. Mitigation methods for all identified impact were set on the study.

The major consumer of energy particularly petroleum is the transport sector. It is also a major emitter of the carbon dioxide that is contributing to global warming. Most of this comes from road transport. However, in contrast, AALRTP emission much less compared to road transport and strong justification for a modal shift from road to rail. Estimate of

total carbon emission from Addis Ababa Road Network and fuel consumption in this sector was included in the feasibility study to understand the cost of saving due to AALRT operations in Addis Ababa from fuel and direct total carbon reduction.

The environment dimension is relatively better assessed in the feasibility study as compared to other factors. However, the assessment was focused on the project life cycle of construction and operation period which has a great negative impact on the overall achievement of post completion sustainability of the project. As described above, when the factors is not treated across all project life cycle, the outcome of the project will be beyond its schedule, budget and may compromise the quality issue which will generate dissatisfaction among the stakeholders.

4.2.4. Technical Performance Dimension

The success of any project is highly depending on the technical performance dimension. This is because, if the project is technically fail it means economically, socially and environmental dimension also will fail as described at the beginning of this chapter. The feasibility study of the project consists of detail specification regarding to technical performance specification. Since it is too technical to understand and interpret the document, the researcher tried to summarize the points regarding to technical performance dimension which was collected through observation and interview based on the factors listed at the beginning of this chapter. Concerning the technical performance of AALRTP, the interviewees assured that the design speed of the project was 80Km/h. However, currently the speed of the train is too lower than the design speed. From the observation, the speed of the train is ranging from 10Km/h to 50Km/h. This is because of two main reasons. The first reason is the distance between the stations is short enough to accelerate the speed of the train. The second reason is the level cross (red zone). Due to these two reasons, the current speed of the train is not achieved the design speed. Regarding to reliability, some of the interviewees reposed that it was very difficult to control the contractor to perform based on the standards since the contract type is Engineering, Procurement, and Construction. The durability of the project is also leave the room due to the contract type. Regarding to the standards of the train and the project, the interviewees emphasized that the standards called "China second level standard". But they don't know about China second level standard. The interviewees replied about flexibility and adaptability, resilience to recover and vulnerability to failure as "it is not a time to know about it. It should be explored after some time of the project operation and delivery of design, construction and implementation document".

4.2.5. Communication Dimension

Communication is a critical factor for any project. From the interview session, the researcher understands that all the interviewees agree with the criticality of the communication

in the project. However, there is no any document regarding to the communication management plan in AALRTP. This indicated that, the stakeholders communication requirements were not identified that enhance the effectiveness of the project communication system. If there are no stakeholder communication requirements, it is impossible to have the communication matrix and as well communication methods and technology used in the project. These forced the project to communicate the stakeholders using the traditional communication system (through letter and telephone) when the need arise. So, if there is no any documents regarding to communication management plan in the project and as it is stated by the interviewees communication is a critical factor for the project, the communication among the project team and with the stakeholders can be put under question.

4.2.6. Coordination Dimension

Regarding to coordination dimension, first and for most, there is no legal entity that coordinate the Utility Services Providers (like Road Authority, Ethiopian Electric Power Corporation, Ethio-telecom, Water and Sewerage Authority and Ethiopian Railway Corporation). This indicated that, the coordination between the Utility Services Providers based on the good will of the individuals (organizations). The coordination between these organizations is random and when the project faced a problem and need the cooperation of other. Such a step will not bring a long lasting solution rather a fire fighting system. Considering coordination as a process of managing resources in an organized manner help the project to achieve high degree of operational efficiency. The absence of proper coordination in a given project is a great crisis particularly for the developing country like Ethiopia which invests a huge budget for the projects.

Due to lack of coordination, one task (which is proposed to be handled by those different Service Providers) can be managed at different time and budget. Moreover, one of the Service Provider who is currently doing the task may damage the system of other Service Provider who did the task before.

5. Summary of Findings and Conclusions

5.1. Summary of Findings

5.1.1. Economic Dimension

The study found out that the ERC does not explore exhaustively the economic dimension of AALRTP. Even if the economic feasibility of the project is the backbone for post completion sustainability of the project, the study investigate that the economic dimension was not treated well. Out of the twenty indicators (sub factors) the documents only covered six of them. The six indicators were not also treated based on the project life cycle. The feasibility study output has contradicted with the strategic plan of 2003 -2007. For

instance, the feasibility study output proved the economic feasibility of the project. Whereas the strategic plan and the interview result proved that the project is not economically feasible. From the interview result, the researcher understood that the organization is proposing and planning some project (construct a building around the station to rent and do advertising using the station and the train screen) to generate money and to make AALRT service economically stable.

5.1.2. Environmental Dimension

The finding showed that the environment dimension is better assessed in the documents than other dimensions. However, it focused only on the construction and operation & maintenance periods of the project by ignoring the inception, planning and design of the project life cycle. But this is totally wrong perception. There is a system principles called that, if you detect the mistakes/the errors at early stage the cost of the project to take a corrective action is minimal than a mistakes/errors that detect at late stage. The researcher finding about AALRTP is just the opposite of this principle. Because, the project document gave an attention to the last two project life cycle phases by ignoring the first three phases.

5.1.3. Social Dimension

The finding indicated that the social dimension is not thoroughly investigated. Out of those sixteen indicators, listed above, the Strategic Plan 2003-2007 only focused on employment opportunities in a general way rather even to treat the employment opportunities at each project life cycle. Whereas the social dimension is treated using one page table entitled negative social impacts of AALRTP – matrix in the feasibility study document. The matrix tried to show the impact of the project on the society in general not on project life cycle bases. The researcher believes the consequence of treating the impact of the project in general will lead the project beyond its schedule, budget and may compromise the quality issue which will generate dissatisfaction among the stakeholders.

5.1.4. Technical Performance Dimension

The findings revealed that the technical performance dimension of the project is not clear among the project teams. If the project is failed technically, the impact also reflected on the other dimensions. It is the pillar of all the rest dimensions for any project. The feasibility study and the conceptual documents (logically looks like the same) contain the detail specifications of the project. The research output proved that some of the technical performance didn't meet the designed performance like speed of the train. The researcher had got very difficult to know the technical performance of the project since the design, construction and operation documents are not at the hand of ERC or AALRTP. According to the interviewees' response, the technical performance will be seen after some time while the project is at operation due to two main reasons:

a. The contract type was Engineering, Procurement, and Construction

b. The design, construction and operation documents was done by the contractor and expected to submit this time since the project is at the closure phase.

5.1.5. Coordination Dimension

The study has concluded that coordination dimension is totally overlooked by the project. Addis Ababa city Administration is launching different projects in all Services Providers (like Road Authority, Ethiopian Electric Utility, Ethio-telecom, Water and Sewerage Authority and Ethiopian Railway Corporation). On the other hand, due to the absence of authorized organization to coordinate these service providers, the country is losing huge money that can get from a process of managing resources in an organized manner through coordination and simultaneously that help the project to achieve high degree of operational efficiency. The importance of coordination dimension is totally ignored by the project as well as by the country.

5.1.6. Communication Dimension

In this information era and globalization, communication is not a matter of alternatives rather a must. Nowadays, people can communicate with others using different communication technology. The role of traditional mail is almost over at this time to be competent in this dynamic business world. However, AALRTP applied the traditional way of communication (letter and telephone) to communicate with their stakeholders. Stakeholder's requirements of communication, communication matrix, communication channel, and etc were not identified.

Generally, the study showed that there is no communication management plan that can serve as a guideline for communications throughout the life of the project and will be updated as communication needs change.

Like coordination dimension, the role of communication is not recognized in the project. However, literature depict that most of the time of a Project Manager's is spent communicating and thinking about it. As a Project Manager, spending most of his/her time measuring and reporting on the performance of the project, composing and reading emails, conducting meetings, writing the project plan, meeting with team members, overseeing work being performed, meeting with clients and many more activities related to the projects without proper communication management plan is futile.

5.1.7. Sustainability Management Plan

The study has concluded that the project does not included sustainability management plan at all. Without sustainability management plan, aspiring post completion sustainability of any project is unthinkable. However, sustainable transportation systems involve a multitude of challenges, including the significant requirements for land and natural resources to build roadways and to power the vehicles that

use them, as well as negative impacts on the human and natural environment from the emissions, congestion, and accidents created by the vehicles operating on those systems that needs to be treated in the sustainability management plan.

5.2. Conclusions

To achieve sustainable infrastructure design, all the three pillars (environmental, economic, and social) must support and be supported by technical performance. The success of any project is highly depending on the technical performance dimension. This is because, if the project is technically fail it means economically, socially and environmental dimension also will fail. The above statement clearly explains a failure of any pillar may cause a failure of all; since the pillars are an interdependent system. Alternatively, strengthening one pillar may reduce the load on another. The process of construction, depending on the complexity of the structure, requires a high level of vertical and horizontal coordination among all the professionals and organizations from design office to the construction site until the project is completed. Without strong vertical and horizontal coordination among all the professionals and organizations, achieving continual benefits from the project is unthinkable. To have strong vertical & horizontal coordination among professionals and organizations (stakeholders), implement proper communication channels is one of the primary objectives of any project. The purpose of the communications sustainability is to define the communication requirements for the project and how information will be distributed to the stakeholders. The Communications sustainability system also sets the communications framework for the project. The project manager will communicate with each stakeholder in order to determine their preferred frequency and method of communication. It will serve as a guide for communications throughout the life of the project and will be updated as communication needs change. The fifth and sixth (coordination and communication) sustainability factors are the bond for the rest factors. This is why the researcher tried to pin point the six factors/dimensions conceptual framework for railway project sustainability under 2.3.

In principle a project always arises from unmet needs. To solve an organizational or national problems one can design a project to overcome those problems. Any major projects were implemented according to their contribution for the socio-economic development of the country. However, to produce continual benefits for long period of time for the project stakeholders (post completion sustainability) is a decisive factor for any project. Post Completion Sustainability of Railway Projects: The Case of AALRTP is also one of the major projects that are expected to contribute for the socio-economic development of the country in general and for the society of Addis Ababa city in particular. These indicated that factors that affect post completion sustainability at inception, planning, design, construction and implementation of railway project life cycle must be

treated well. Therefore, this study has discussed the major indicators and sub indicators which should influence post completion sustainability of railway project.

In addition, the framework that I propose can be used as a stepping stone for decision makers in general and it is a fantastic eyebrow in the area for Ethiopian Railway Corporation in particular.

Railway projects involve huge capital investment, and it takes long time for a railway project to take shape from formulation of ideas, conceptual planning, consultation with stakeholders, detailed design, to actual construction and completion. As they have profound impact on people's livelihood and socio-economic development, we have to be forward-looking and make timely plans for our railway development in future. In planning future railways, transport demand and cost-effectiveness are important considerations, as are the wider socio-economic benefits they will bring about.

Based on the findings of the study, coordination and communication factors/dimensions were totally ignored or forgotten by the ERC from the very beginning to the end of the project life cycle. The findings of the study indicate that the economic factor/dimension assessed by the ERC in different documents contradicted each other. One of the documents proved the economic feasibility of the project and the other was not. The social and environmental factors/dimensions were not treated based on the project management life cycle and tried to cover very few sub factors in the documents. Since the contract type was Engineering, Procurement, and Construction, the respondents and the documents stated nothing regarding to the technical performance factors/dimension.

To generalize, Ethiopian Railway Corporation didn't investigated thoroughly the factors that affect post completion sustainability from the inception to closure of project management life cycle in AALRTP though post completion sustainability of any project is crucial than launching and running a project.

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