ASSESSMENT ON INTEGRATED INFRASTRUCTURE MANAGEMENT PRACTICE IN ADDIS ABABA: THE CASE OF AKAKI KALITY SUB CITY

By:

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A Thesis Submitted as a Partial Fulfilment to the Requirements for the Award of the Master's Degree in Construction Technology and Management

To

THE DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

August, 2024

Addis Ababa, Ethiopia

ADDIS COLLEGE

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APPROVAL PAGE

Title: Assessment on Integrated Infrastructure Management Practice in Addis Ababa: The Case of Akaki Kality Sub City

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DECLARATION

I, the under signed, declare that this thesis entitled "Assessment on Integrated Infrastructure Management Practice in Addis Ababa: The Case of Akaki Kality Sub City", is my original work and has not been presented for a degree by any other person to the best of my knowledge, and that all sources of material used for the thesis have been properly acknowledged.

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CERTIFICATE

This is to certify that the thesis prepared by Beza Abera “Assessment on Integrated Infrastructure Management Practice in Addis Ababa: The Case of Akaki Kality Sub City”. And it is submitted as partial fulfilment for the requirement degree of masters of Science in Construction Technology and Management complies with the regulations of the college and meets the accepted standard concerning the originality, content, and quality.

Advisor: Sign Date

Amlaku M. (Ph.D. Candidate.) _____

_____

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ABSTRACT

Integrated infrastructure management provision is very essential for the modernity, social and economic development of urban localities. The efficiency these infrastructure provision is determined by the responsive act of policy makers, utility authorities, municipalities as well as stakeholders. The objective of the study is to assess the practices of Akaki Kality sub city in applying the integration of infrastructure management system among Addis Ababa city Roads and major utilities. Inadequate cooperation, communications and consultation among implementing agencies which often shove each other to use same space in order to advance or implement their projects simultaneously. The study employed both quantitative and qualitative research approaches. Data were collected through questionnaires, interviews, documentary review, and observation. The data from questionnaire were analyzed using descriptive statistics such as frequencies and percentages and presented using tables. The results revealed that current institutional integration is good but stronger institutional frame works are needed ,communications is most efficient at planning stage but less during construction and maintenance stage information and technological capacity and lack of central database the tools which support the accelerated and informed decision making and effective information and data exchange has become significantly challenge in implementing effective and integrated infrastructure management system, and regarding to system that develop sustainability of integration there must be a standard governmental protocols through various utility providers ,a specific governance team should be created. To make the future integration system more effective, it is recommended that organizational capacity building workshop among different stakeholders, developing central database for an appropriate data sharing and exchange platform.

Key Word: Infrastructure Integration Management implementation.

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LIST OF ACRONYMS

AACRA	Addis Ababa City Road Authority
EEPCo	Ethiopian Electric Power Corporation
AAWSA	Addis Ababa Water and Sewerage Authority
ETC	Ethiopian Telecommunication Corporation
GPS	Global Position System
GIS	Geographic Information System
IUISP	Integrated urban infrastructure service planning
IMS	Infrastructure management systems
SPSS	Statistical Package for the Social Sciences
IIMS	Infrastructure integration management system
AAIIA	Addis Ababa Infrastructure Integration Authority
CCB	Central Coordinating Body
IIP	Integrated Information Platform
JPB	Joint Planning and Budgeting
BIM	Building Information Modeling
CBT	Capacity Building Training
PME	Performance Monitoring and Evaluation
SMP	Standardized Maintenance Procedures
RMF	Risk Management Framework
PPP	Public Private Partnerships

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

The rapid urbanization presents many challenges. One of the most urgent is how to provide infrastructure solutions that can cope with the stress caused by this massive expansion of populations in concentrated spaces. Cities must build, maintain, and upgrade extensive transport, power, water and telecommunication networks, in order to keep up with the demands of economic development and population growth. Those infrastructures are necessary to continue to progress societies and improve living standards. Infrastructure is a network of interrelated basic facilities and services that provides an adequate environment for human living (Thomas, 2017). A city infrastructure is a system of connected utilities, basic facilities, and services of that city, from the smallest units of the community (houses) to the significant city structures and buildings that render services such as electricity, telecommunication, sewage and sewerage and water supply.

Ethiopia is currently among the fastest-growing nations, in part because the construction industry of which road development is one has been accorded priority. This industry is delayed and prevented from expanding by a number of difficulties. A major obstacle stems from the lack of collaboration for the coordinated construction of infrastructure. The issue of inadequate coordination for integrated infrastructure development is widespread in Ethiopia's capital city of Addis Ababa. The building of various utilities has unique characteristics that are not found in other industries in the range of operations and procedures, despite the fact that it plays a significant part in citizen life (Desta, 2017).

An infrastructure project is a kind of public good in which government policy has an important role to influence the effects of the project on economic development and social needs. The term infrastructure covers a range of services, from public utilities such as power, telecommunications, water supply, sanitation and sewerage, solid waste collection and disposal, and piped gas; to public works such as roads, dam and canal works, railways, urban transport,

ports and waterways, and airports (World Bank, 1994). According to Mathewos Consult (2006), an infrastructure project is one that is built, installed, maintained, upgraded, or renovated by the appropriate implementing organization. These infrastructural projects do not stand alone.

Most public works infrastructure projects, in particular, have the following characteristics in common: High fixed costs (capital intensive), a long economic life, a monopoly on the local market, interaction with other infrastructure, and one or more of the following (James, 2015). One of the most pressing issues is how to develop infrastructure options that can withstand the strain brought on by this enormous population growth in confined areas (Thomas, 2017). To meet the needs of economic development and population increase, cities must construct, maintain, and update large transportation, power, water, and telecommunication networks.

In case of integration of infrastructure management, electric power, water supply, storm water drainage and telecommunication systems are the major components of this study.

Most road utility infrastructures could be realized through underground, surface and/or overhead networking systems. Electricity and telecommunication customers are supplied via overhead wires or underground cables through an installation to the ground or in a network of ducts (Desta, 2017). The reliability and efficiency of this infrastructure provision is very important to modernize urban development through the responsive act of utility authorities, municipalities, planners, policy makers as well as stakeholders. But all responsive authorities have not fully integrative.

Infrastructure Integration management involves making adjustments among the various objectives and supervising the interdependence which exists between the knowledge areas (Invensis, 2017). The Integrated Infrastructure Management System is intended as a computer-based management tool that will use cutting-edge data gathering and management technology to give more accurate, reliable, and effective decision-making data. The IIMS will incorporate features for user-friendly information access, scenario development, inventory, condition evaluation, and predictive modelling (Andrew, 2008). According to Andrew (2008), an expanding body of research is assisting professionals and Policy-makers to comprehend that infrastructure exists as a connected system and that this system's effective operation is essential to our environmental quality, economic well-being, and general quality of life. The most

common problems arise from poor planning, coordination and integration of major road utility line; eventually leading to potential risks arising from delay in schedules, frequent scope changes and ultimately project deliverable that don't meet expectations. The aim of this study was to assess the Integrated Infrastructure Management Practice in Addis Ababa: The Case of Akaki Kality Sub City.

1.2. Statement of the Problem

Addis Ababa, is a capital city of Ethiopia and, the city's population growth has radically increased and becoming much more dependent on major utilities infrastructure .And also, as the place where Africa Union sit and many international diplomats' residence providing quality utilities service is critical, for countries economic growth, by attracting Tourist and investment to the city and enhancing social status. Despite, the city faces big challenge arises from lack of implementing the infrastructure development in an integrated way (Desta, 2017). Sub city of Akaki Kality is one of the eleven sub cities of Addis Ababa and is the industrial zone of Addis Ababa as well as the country. In this sub city there is a high flow of heavy load truck that's pass through this sub city and transport different imported items from outside the country and there is also a high flow of various vehicles. However Roads are highly crowded and very tiring all the time.

Nowadays Akaki Kality sub city as seen a sharp rise in population in the expansion area, and as a result, the sub city is relying more and more on its key utility infrastructure. However, the lack of an integrated infrastructure management strategy between the Addis Ababa City Road Authority and main utilities provider (such as Ethiopian electric power authority (EELPA), Addis Ababa water and sewerage authority (AAWSA), and Ethio telecom is a significant difficulty for city of Addis Ababa as well as Akaki Kality sub city. When utility companies need to Install new lines or improve the existing ones underneath the roads, they used to apply the Addis Ababa City Road Authority (AACRA) for a permit to cut paved roads.

Very often permits were not granted promptly. Besides, the permits given were not based on adequate information and a database. The concerns of the utility company that secured such a permit were limited only to laying its utility lines. As a result, such developments often took place at the expense of the other utility lines that were already in place. For example, as we see

our surroundings these infrastructures are conflicting with each other after the road is constructed water and sewerage authority or telecommunication demolishes it, which harms the community, and even it needs additional costs for the road to be reconstructed. It has also resulted in delays in the implementation of projects thereby adversely affecting overall city infrastructure and services provision.

According to a recent disclosure by (Desta, 2017), while spending billions of Birr and developing development-oriented policies, there is a lack of integration among the various utility providers, which leads to project delays and capital inflation in addition to causing disorder in day-to-day operations. Some previous studies reveal the existing practiced infrastructure integration management system is very poor municipalities are facing unprecedented challenges in the management of infrastructure assets due to the increasing number of aging infrastructure assets, the ever-increasing demand and sustainability requirements, increasing maintenance deficit, and declining or static maintenance budgets in relation to Addis Ababa City infrastructure development projects.

Therefore, the aim of this study is mainly to understand the existing city infrastructure integrated management practice and investigate the potential challenges from currently utilized tools and technology in Akaki Kality sub city. Since, the above mentioned studies have gaps in showing what challenges the infrastructure project integration from the tools and technology respective.

1.3. Research Objective

1.3.1. General objective

The overall aim of the study is to assess the practices of Akaki Kality sub city in applying the integration of infrastructure management system among Addis Ababa city Roads and major utilities and to provide possible integrated infrastructure implementation mechanisms.

1.3.2. Specific Objectives

Specifically, the study tries to address the following key research objectives:

1. To assess the current practices of implementation of integrated infrastructure management in Addis Ababa, Akaki Kality sub city.

2. To identify the challenges in implementing an integrated infrastructure management in Akaki Kality sub city.
3. To develop a system that will enable for sustainable infrastructure integration management in Akaki Kality sub city.

1.4. Research Questions

The study is guided by the following research questions:

1. What are the practices of implementation of an integrated infrastructure management system between Addis Ababa city road authority and major utility providers?
2. What are the challenges for the effective implementation of an integrated infrastructure management system between Addis Ababa road and major utilities?
3. What are the possible mechanisms to be applied in the implementation of an integrated infrastructure management system?

1.5. Significance of the study

This study will shed light on the service-providing industries that are directly or indirectly involved in building roads as well as the ongoing issues in the construction sector. Each sector will then be able to avoid such issues by working together harmoniously and understanding the consequences. This implies the creation of a standard or manual for coordinating and developing an integrated system of infrastructure development.

The results of this study will provide a review and additional aid in understanding the subject's context in relation to the issue, consequences, and solution for infrastructure development integration in Ethiopian road constructions, particularly in Addis Ababa, Akaki Kality sub city road and other infrastructures construction.

1.6. Scope of the study

The system that each utility provider employs as well as the disjointed infrastructure of new projects, maintenance, rehabilitation, and expansion projects. Since the most basic concepts of integration management systems emphasize the necessity of integration and coordination among concerned actors at different hierarchical levels, including the strategic, operational, and

technical level, as well as on an accurate characterization of the techniques and technologies currently employed to support various decision-making processes (Andrew, 2008).

This study focuses on examining the practice of integrated infrastructure management in Addis Ababa, Akaki Kality sub city on the road and major utilities. The study covers major issues of practice, challenges and developing a system of sustainable integration infrastructure management of Akaki Kality sub city road and major utilities on current situations.

It is visible that the scope of the topic is wide, but assumed though this case happens at almost in a road section of existing time in Addis Ababa, Akaki Kality sub city. In addition to secondary data from the Addis Ababa city administration building permit and control authority such as planning and implementation, the study gathers and analyze primary data from experts in purposefully selected offices of Ethio telecom Ak/Kality branch, EEPCO Ak/Kality branch, AAWSA Ak/Kality ,AACRA, Municipalities sector, Addis Ababa building permit and control authority team of infrastructure permit and control and also other stakeholders involvers particularly in Akaki Kality Sub city in infrastructures construction like consultants and contractors through question and interview format. So, efforts was made to review the most important aspects of the topic. Moreover, the common time and financial limitation are taken into consideration.

1.7. Limitations of the Study

The most constraints of this study include: lack of available data Infrastructure management systems may not have comprehensive data on the condition and performance of assets, which can make it challenging to assess their integration and effectiveness. And also assessing integration infrastructure management requires understanding the complex interdependencies between different infrastructure systems this complexity can make it difficult to develop standardized assessment frameworks and metrics. Infrastructure systems are constantly developing with new technologies and approaches emerging this can make it challenging to assess integration as the needs and capabilities of infrastructure management grow over time. The study comprises multiple stakeholders, including government agencies, infrastructure operators, and the public. It can be challenging to engage and coordinate these stakeholders,

especially when their interests and priorities may differ. This study also requires significant resources, including time, expertise, and funding.

Overall, these limitations highlight the challenges and complexities in studying assessment on integration infrastructure management practice. Despite these limitations, efforts are being made to develop methodologies and frameworks that can better assess and evaluate the effectiveness of integrated infrastructure management.

1.8. Organization of the Thesis

This thesis is organized with the preliminary pages of the thesis document consisted of the title page, approval sheet; acknowledgment, abstract, table of content; list of figures, tables and acronyms. The body part accounted five chapters, within each chapter there is different but interrelated subtopics. The first chapter contains the introduction part which comprised the background information, problem statement, objectives, Research questions, significance, scope, limitation, organization and description of the study area. The second chapter consisted of the literature that is to be reviewed. The third chapter is the research material and methods which covers the research methodology, research design, data source, data type, data gathering tools, data analysis and data presentation. The fourth chapter discusses the results and discussion part of the study which concerned about data presentation and discussions with the analysis of the primary and secondary facts with the qualitative study approach. The last chapter provided the conclusion and recommendation of the study.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Introduction

In this chapter theoretical and empirical reviews have been discussed. In the theoretical section: definition of terms, urban infrastructure, concept of integrated infrastructure, integrated management and other related ideas have been incorporated. While in the empirical review, previous research works that are related with the study of this research have been incorporated. Finally, conceptual frame work is incorporated as a separate section of the chapter.

2.2. Theoretical review

2.2.1. Definitions of Terms

An infrastructure project is a kind of public good in which government policy has an important role to influence the effects of the project on economic development and social needs. The term infrastructure covers a range of services, from public utilities such as power, telecommunications, water supply, sanitation and sewerage, solid waste collection and disposal, and piped gas; to public works such as roads, dam and canal works, railways, urban transport, ports and waterways, and airports (World Bank 1994). Infrastructure is the foundation for social and economic development; thus, investments in infrastructure are particularly important in developing countries. From 1970 to 2005, more than 30% of the World Bank's investments were in developing countries for implementing various infrastructure projects (World Bank 2006).

Infrastructure: is defined to denote the hard component that comprises all systems of urban physical structure that are mainly laid under the ground (e.g. water mains) and on the ground (e.g. Roads) or above the ground (e.g. telephone and electric lines) to provide public services. Infrastructure in the context of this manual includes roads and drainage, utility lines (water supply, electricity, telephone,) and facilities such as public transport terminals, garages…etc. (IUISP infrastructure and service manual, September 2006,)

Transport can be defined as any means used to move people and/ or products. The transportation system includes roads (under different levels of jurisdiction), transit services, rail services, bicycles lanes, footpaths, trails waterways and ports, air travel and airports, pedestrian accommodations, terminals, and storage facilities

Road: means any public thoroughfare whose primary purpose is the conveyance of vehicular and non-vehicular traffic.

Water supply: includes the source of water, treatment plant, reservoir and tankers, the main trunk lines, distribution lines, and individual connection lines that are laid for the delivery of potable water.

Sanitary sewer network includes a system of underground lines for the collection and removal of liquid wastes from different urban functions (residential, commercial, and industrial) and treatment plants.

Electric network includes: a system of lines of wires/cables (low, medium, and high tension lines), transformers, substations, and electric generation stations (hydro-power, thermal power…) for the supply of electric power to different urban functions.

Telephone lines are a system of lines of wires/cables laid to carry telephone messages. Data integration is defined as "the process of combining or linking two or more data sets from different sources to facilitate data sharing, promote effective data gathering and analysis, and support overall information management activities in an organization" and integrated decision-making.

2.2.2. Urban infrastructure

Most cities of developing countries are faced with various problems including which high incidences of poverty and unemployment, and poorly developed infrastructure management which is a result of a lack of different strategies and mechanisms for integrated planning, management & implementation of utilities among the different authorities, inadequate public services, the provision of physical infrastructure and services to continually lag behind the urban

population growth rate. These problems are mainly the result of the mismatch between their rates of population growth and their paces of economic development.

Ethiopian Urban centers are characterized by, among others, a lack/shortage of basic urban infrastructure and services. It is also widely observed that the existing revealing infrastructure and services in the urban centers are deteriorating mainly as a result of poor design and installation practices and due to a lack of timely maintenance. On top of this, the lack of coordinated and integrated infrastructure and services planning and implementation has exacerbated the problems observed in the infrastructure development effort of the country. (IUISP final draft) The increase in population generates greater infrastructure demand, including road and urban utility facilities. When road and urban utility infrastructure facilities are not properly provided, integrated, or planned for a long term and implemented for a long period in a given urban area the performance of road infrastructure can be limited and the life span of road infrastructures and other urban utilities will be shortened because most of the time road infrastructure influence the locational pattern. (Dagnachew Adugna research paper, July 2011, page 217).

2.2.3. The Concept of Integrated Management System

Integration means to look at all circumstances that might affect the plan or project in a holistic manner (Geyer 2006:2). The highest level of integration combines the structured processes for decision-making with the planning, financing, execution, and management of many sectors. Prior to applying complete integration, the other lower levels should function smoothly, effectively, and efficiently because this is the most difficult level (Oluwole, 2017). It also necessitates the existence of a single structured decision-making system and the processes that make it possible for such a system to exist. For it to function, cooperation and coordination are both necessary. In order to accomplish a specific set of goals, integration may enable a more effective and efficient use of resources (MATHEWOS Consult, 2006).

Managing program interfaces and multitasking, identifying organizational constraints and taking advantage of them, keeping an eye on accountability, monitoring team performance and dynamics, analyzing project business value at the highest level, monitoring projects to ensure midstream adjustment and project recovery, resolving technical, resource, and interpersonal

conflicts at every level, and reporting to prevent ethical and waste issues are all part of integration (Shimeles, 2007). Integration may take three forms (MATHEWOS Consult, 2006), which are:

1) Integration within an infrastructure sector/entity (intra-sectorial integration): for example integration within the road sector between Road Authority (arterial and sub-arterial road) and local government and community initiatives (local and collector road),

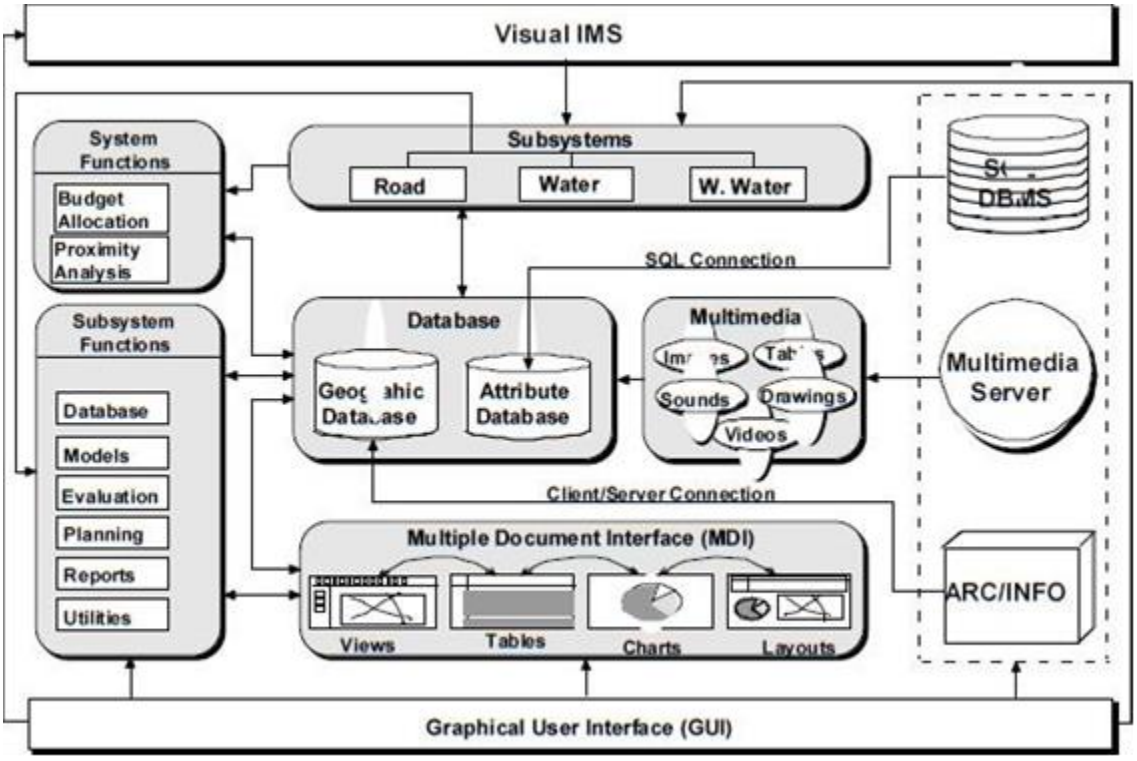

Figure 2.1 System Functional Framework Design for IMS

Source; Zahmin.Z, (1998)

2) Integration between infrastructure entities (inter-sectorial integration); integration between different sectors/infrastructure entities,

3) Integration of infrastructure with other urban development sectors housing, business, industrial areas, etc. (which is also inter-sectorial integration). Traditionally, distinct divisions within utilities service providers or public works agencies use various management methods, claims (Zamin Z, 1998). The majority of systems were initially created and used as standalone,

application-specific systems. Systems differ in their data architectures, which can range from straightforward flat files to intricate relational databases.

These systems' incompatibility has seriously hindered the management collaboration and data exchange that are required by diverse units at all levels. Numerous academics have suggested integrated systems as a solution to this issue. In addition to this, it should be made clear that integration does not suggest the formation of a massive and complex system simply by lump-sum combination; rather, it denotes a process where all of a system's components are logically brought together utilizing a modular approach on a shared platform. Fig. 2.1 provides an illustration of the idea of an integrated infrastructure management system, with a GIS serving as the platform for integration and a geographic location acting as the integrator.

According to Zahmin (1998) made his conclusion on advantage of using integrated information System.

A) A new generation of infrastructure management systems (IMS) is emerging to enhance several features of conventional management systems.

B) Integrated information and management systems provide an opportunity for improved infrastructure system management. By coordinating all management tasks among connected subsystems, an integrated system not only provides administrators and engineers with an outstanding method to satisfy the demands of data sharing and information exchange, but also aids them in making the best decisions possible.

C) Although the integration of infrastructure management systems can be accomplished with different mechanisms, GIS is one of the most desirable integration platforms. In addition, GIS can coordinate data from different databases and integrate traditional attribute data with spatial data to perform sophisticated spatial analysis.

D) Emerging technologies in data collection, processing, communications, analysis, and display can significantly improve the practice of infrastructure management. Multimedia, client-server architecture, and GPS are the most important ones. With proper integration and configuration, these technologies can make an IMS handle a wide variety of data visually, analyze them spatially, and present the results graphically, in a distributed computation environment.

E) The idea of generic models is useful for creating infrastructure management decision support systems. Generic models are employed since Visual IMS is a general system rather than an application-specific system, allowing the system to be altered and put into use by other agencies. While the framework of a generic model remains the same, users can readily alter its parameters to match their local knowledge and customs.

In 2000, the Office for the Revision of the Addis Ababa Master Plan made an attempt to create a comprehensive database of infrastructure. The office created an existing infrastructure network database that displays road, drainage, water, and telecommunication lines on a single, integrated map. The creation of an infrastructure authority has also been suggested in the updated master plan for better coordinating and integrating the infrastructure institutions operating in the city. The Addis Ababa Infrastructure and Construction Authority was founded when the City Administration underwent reorganization in 2003. The Authority was given the authority to oversee and coordinate the initiatives of infrastructure institutions.

2.2.4. Integrated management Information (IMI) Approach

The information exchange system includes all communicating entities from the substation to the different management platforms of the power utility (power network management, energy management, enterprise applications, etc.). A more general concept of integrated management information can therefore become attractive. In this case, the NMS need not be a single geographical entity but a distributed platform serving the different functional layers of the infrastructure and the different functions in the utility organization (cable monitoring, system administration, telecommunication network management, security monitoring, etc.) (Cigre, 2008). At present, the different components of the communication network are connected and managed through dedicated vendor specific network management systems generally located at a control center. Many utilities desire to "integrate" their different NMS components, without a clear definition of the significance and extent of the integration and the functionalities to be obtained. An integrated management information system is a common platform that permits the different information processing, storage and exchange systems and other associated infrastructure components in the power utility to interact, in order to perform different tasks such as asset management, maintenance, condition and performance monitoring, administration,

planning and supervision. It overcomes the problem of multiplicity of management systems in a multi-vendor, multi technology environment as exists in most.

Telecommunication networks, IT infrastructures and different automation and system monitoring components. It also allows a global vision of the utility information infrastructure, relating the different layers and components, which are otherwise divided into separate worlds, and hence provides a better and faster understanding of the cause and consequence of different system events through sharing of management information on the utility scale (Cigre, 2008). Current research focus in the construction industry is directed at implementation of an effective information management based integrated system environment. Construction organizations are developing methodologies of integrating information technology in the work environment of their operations. All construction process improvement strategy is based on integration of effective project planning,

Monitoring and control techniques provided by an enterprise level of integration of all organizational parameters, functions, members and incorporated technologies. Creating an automated information system in computerized environments via networks using web-based technology enables top-level management to visualize various types planning information to support decision making (Attila, 2004)

2.2.5. Mechanism of integration

An integrated data system is built on an approach to data governance that is intentional, whole-of-government, and multi stakeholder. Implementation of such a system depends on a country's data maturity. Highly skilled human resources in government, civil society, academia, and the private sector are critical to maintain an integrated national data system. Infrastructure management systems can be integrated in different ways. However, data sharing which employs geographical information systems (GIS) is one mechanism which offers great promise and existing integration mechanisms are as follows (Zahmin.Z, 1998):

1. Manual data sharing: as the simplest, flexible method, manual data sharing uses diskettes or tape drives as the medium to exchange data and information. Though primitive this method is still in wide spread use.

2. Automatic data sharing: the automatic method differs from the manual one primarily by its medium of data transfer. Instead of using diskettes or tapes, this method provides data sharing via network wires, which is efficient for frequent data transfer.

3. Standardization of data: another level of integration can be achieved by standardizing data items, definitions, collection procedures, quality, and updating schedules. Standardization is especially important for a central database involved in data sharing.

4. Standardization of analysis procedures: data sharing includes not only data items directly collected in raw form, but also those generated as outputs from analysis procedures. For an integrated system, some analyses may require certain inputs that are output from prior analyses.

5. Policy and decision-making integration: the information generated from the proceeding levels of integration can be used by administrators to develop coordinated policies and to make comprehensive decisions. Such an integrated approach of administration can make the best use of available resources.

6. Integrated systems: the most desirable one is the integration of separate management systems. An integrated system does not necessarily mean combining everything into one grand "lump-sum" system; rather the integration should be carried out by using a common platform. Because of the geographical nature of transportation and public works, GIS is an excellent integration platform using location as the integrator.

2.2.6. Infrastructure Management System

The management system consists different elements (material, information) that are input for the output with a transformed one. so, the main goal of an infrastructure management system is to reach and manage defined, updated and reliable data on the physical and performance characteristics of infrastructure assets, in order to allow the user a simple, quick and efficient access to data, by means of which to detect and predict the performance levels given by infrastructures, to plan the maintenance works and to allocate financial resources. In particular, the necessity to share territory information among all subjects involved in the technology networks. Within the international context, it emerges the development of experiences aiming at overcoming such condition by means of a change in the geographic information sciences based

on the development of open and distributed systems (Sivo, 2010). Integration management represents one of the most basic requirements to guarantee a coordinated management, even though the problem of information system integration and interface is still one of the most difficult to overcome.

It is a matter of fact that information technologies represent a crucial part in any supporting decisional tool within asset management (Sivo, 2010); an efficient data management becomes indeed a key element for the improvement of the decisional process related to municipal infrastructure management.

2.2.7. Performance Management system

Project performance management enables you to track and monitor financial and schedule-related performance for projects. Performance Management provides the mechanism to measure whether targets to meet its strategic goals, set by the organization (Attila, 2004). Performance Management is a process which measures the implementation of the organizations strategy. It is also a Management tool to plan, monitor, and measure and review performance of indicators to ensure efficiency, effectiveness and impact of service delivery by the infrastructure institution .And also defined as strategic approach to management, which equips leaders, managers, employees and stakeholders at different levels with a set of tools and techniques to regularly plan, continuously monitor, periodically measure and review performance of the organization in terms of indicators and targets for efficiency, effectiveness and impact (Bruce, 2006). According to (Attila, 2004), Purposes of Performance Management System are:-

1. Encourage more responsibility and supervision between the municipal government's political and administrative branches, as well as between each sectoral department and the office of the municipal manager.

2. Provide early warning signals for each sector Heads of Departments, the Municipal Manager, Clusters, Standing Committees, Mayoral Committee and the Executive Mayor with a diagnostic signal of the potential risks that are likely to affect the realization of full infrastructure project implementation. It is important that the system ensures that decision- makers are timely informed

of risks, so that they can facilitate interventions, where and when it is necessary and possible to do so.

3. Enhances decision-making by providing appropriate management of information that will allow efficient, effective and informed decision-making, particularly in so far as indicating where the allocation of resources should be prioritized in order to meet institutional or strategic goals.

2.3. Empirical Literature Review

2.3.1. The Absence of Accountability

The environmental quality and effectiveness of the urban transportation system have been significantly impacted by the frequent cutting of municipal streets by different utility providers. (Hailmaryam, 2011) claims that the lack of a responsible entity is still the main reason for the coordination's poor quality. The AACRA claims that the lack of a sense of responsibility and belonging is a major factor in the low degree of integration. The lack of a structure that ensures accountability has led to the current weak or low degree of integration. The institutional accountability and responsibility plan is the only means by which integration among the stakeholders can be achieved, according to AACRA.

2.3.2. The Challenge of Infrastructure Planning

Based on the investigation completed to date and experience from directly-related projects (Vanier and Danylo, 1998), the authors recognize that there are a number of administrative, financial and technical challenges in the area of municipal infrastructure planning:

- Seamless data integration is difficult to achieve, but an essential feature of the software environment for a domain such as asset management.
- Any software development should be done in partnership with software companies.
- There is no central repository or source for information for the domain of municipal infrastructure planning.
- There is a need to share experience and “best practices” regarding municipal infrastructure planning. And
- There is little or no intercommunication between municipal infrastructure research and the field of service life research.

2.3.3. Decision Making Support

The decision-making process for infrastructure management is inherently interconnected and necessitates the integration of numerous processes, software systems, and data sources. Current work practices have significantly fragmented processes and data, which has led to severe inefficiencies and prevented the deployment of efficient management solutions. There is a broad consensus in the industry that adopting integrated multi-disciplinary approaches is a key requirement for implementing efficient, sustainable, and proactive asset management programs (Halfawy, 2008). The integration among systems requires the first challenge to improve the efficacy. An unavoidable goal for future developments is undoubtedly the data integration. It is important that Public Administrations and Authorities - which are developing this kind of tools – share their own experiences and best practices (Jenifer, 2015). Integrated infrastructure management would facilitate information flow across various disciplines and activities, which in return would improve the availability, reliability, and consistency of infrastructure information, resulting in timely and more efficient decisions Ferreira and Duarte (2005). Infrastructure decision-making requires access to a multitude of data about infrastructure inventory, condition, risk levels, performance metrics, renewal options, etc. Efficient representation, integration, management, and sharing of these data sets can only be practically achieved through the use of comprehensive and integrated databases. Data management services such as multi-user data access and editing, concurrency control, version management, data security and authentication, and other services critical for ensuring data integrity and consistency can only be realized using an integrated database (Halfawy, 2008).

2.3.4. Current Infrastructure Integration System

2.3.4.1. Federal Control and Permit Authority

Recently, the Federal regulatory agency, integrated infrastructure development, construction permit and control, has been established with Proclamation (Ethiopian Federal House of Public Representatives, 2014) As stated on this article, the Agency’s main objective is to coordinate the execution of integrated infrastructure development works in accordance with roads master plan and to develop formula for the assessment of compensation for properties to be removed. And landholdings to be expropriated due to· integrated infrastructure development works. Some of

powers and duties of the Agency is: to prepare, in collaboration with other relevant implementing organs, national integrated infrastructure development works plan and master plan; ensure that they are executed by the implementing organs; cause their implementation to be undertaken by regions, as may be necessary; as well as provide the necessary support for integrated infrastructure works undertaken by regions.

2.3.4.2. Addis Ababa City Administration Building Control and Permit Authority

Previous trend in Addis Ababa, when utility companies (ETC, AAWSA, and EEPCO) needed to install new lines or to improve the existing ones underneath the roads, they used to apply to the Addis Ababa City Road Authority (AACRA) for permit to cut paved roads. Currently, the Addis Ababa City Administration had established a new organ to conduct similar tasks as the FIIDCA.

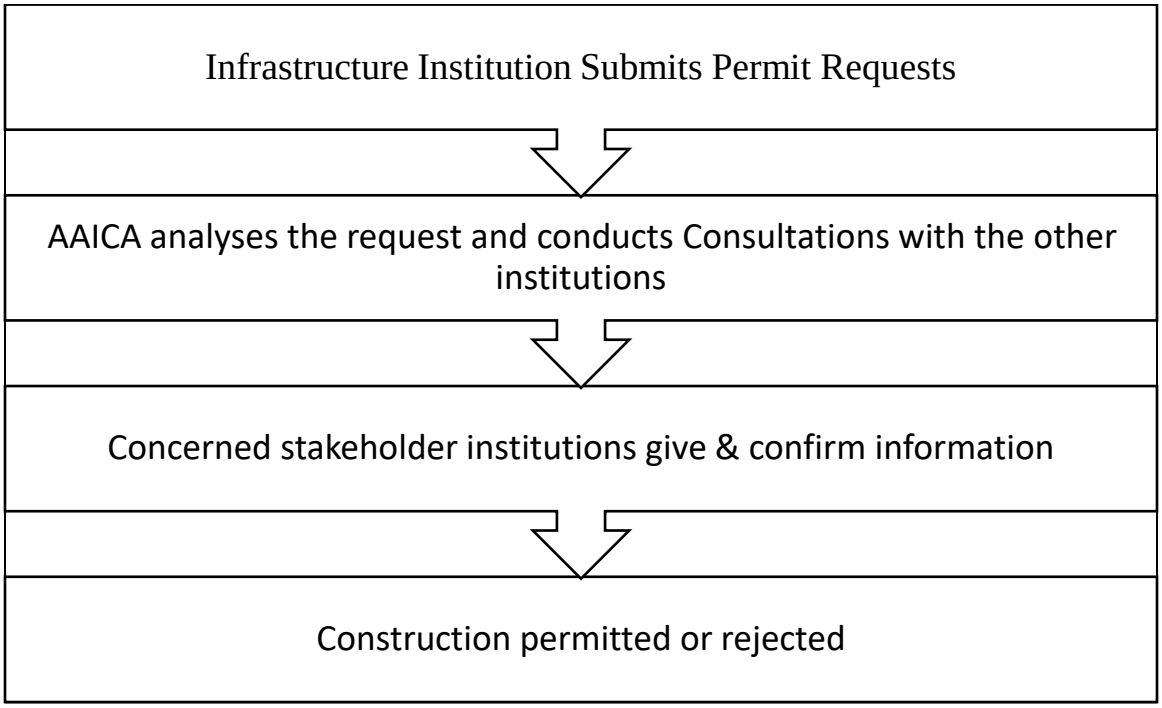

Figure 2.2: Integrated Infrastructure Construction Permit Process

The Infrastructural Development Integration & Building Permit & Control Authority was formed after the city council approved its establishment with Proclamation (Addis Ababa City Council, 2017). Aside from issuing permits, the Authority collaborates, consult and implement alternative

dispute resolution approaches during the early stage of project preparation. This allows the authority to revoke the permit if the utilities‟ owners are unable to comply with its condition.

2.4. Conceptual Framework

IUISP needs to be located in broader urban planning frameworks of the IDP and the structure plan. They are city level frameworks, which are bases for guiding IUISP. The timing and schedule of the planning and implementation of IUISP should coincide with the structure plan (10 years) and the IDP (5 years) of municipalities/city governments. IDP includes other sectors apart from infrastructure; like environmental development programs, housing, social services, and social and economic development programs. Thus IDP is much more comprehensive than IUISP. The IDP helps to articulate and link the infrastructure investment with other urban development programs, and ensures integration and coordination on a larger scale.

Spatial element deals with the linkage of infrastructure programs, linkages with other development programs, land uses (i.e. housing, industrial development etc.) and overall physical conditions in a specific geographical area. Financial element deals with the budgets, revenue and management of financial resources for infrastructure development. The final output of IUISP has three major components for integrating the above-mentioned elements, which are Physical, and Environmental Development, Revenue Improvement and Institutional Development. The physical and environmental development component deals with the technical and spatial elements of sectors, selected physical infrastructure prepared with spatial plan including determined infrastructure needs, identified projects, financial and technical feasibility and detailed designs (MATHEWOS Consult, 2006).

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. Introduction

In this chapter the way the research is done have been discussed. The chapter is provided in sections and sub sections. This includes description of study area, research approach and research design, target population, sampling technique, sample size, data collection method, data analysis and validity and reliability.

3.2. Description of the Study Area

The study area is focused in Akaki Kality sub city. One of the biggest challenges derives from the absence of cooperation for the integrated management of infrastructure. Akaki Kality, one of the eleventh and expansion sub city of Addis Ababa which has encounter largest plot area and main roads pass through .The problem of lack of coordination for integrated management of infrastructure is common. Even though the construction of different utilities plays a great role in the life of the citizen, it has special features that are not encountered in other industries in the range of operations and processes. Akaki Kality sub city's located at 8°55′38″ N ,38°46′5″ E and its elevation above sea level ranges from 1500 m to 2300m.

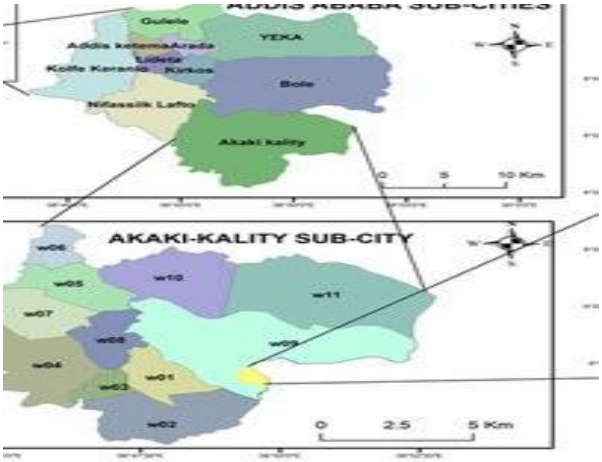

Figure 3.1 Map of Study area

3.3. Research Design and Approach

3.3.1. Research Design

The research is adopt both qualitative and quantitative approach and uses a descriptive and mixed research design with the goal of enhancing information dependability and complementing quantitative and qualitative data. The identification of relevant factors from books, journals, periodicals, research papers, handbooks, and recommendations would be the first step in the study. There is a desk study carried out concurrently with the literature evaluation. A variety of papers, including plans for various road projects, city master plans, utility infrastructure projects, work schedules, strategies and manuals for infrastructure offices, designs, progress reports, completion reports, etc., critically assess throughout the desk research.

Whenever there is unclear primary data or ambiguity during the desk study, further explanation or information obtained through interviews with relevant bodies to maximize clarity and to perceive an adequate understanding of the data for its use in the analysis. The analysis and discussion was followed based on the primary & secondary data obtained. The analysis write-up was followed by the analysis and discussion part.

Finally, conclusion was drawn and recommendations forwarded based on the finding of the study or from the collected data and reviewed literature.

3.3.2. Research Approach

The study employed inductive approaches moving specific to general that begins with empirical observation namely the collection and analysis of data. Generalization is made on the basis of observation, questioners, interviews and important secondary data which is a qualitative type of research. Triangulating the data obtained using the aforementioned methods to arrive at a secret relative truth. Also employ a descriptive type of research design to make intensive investigation the application of sustainable construction methods, opportunities and any related challenges. Hence, to maintain triangulation in its findings, the design is conducted using qualitative and quantitative research approaches. Both qualitative and quantitative data was used in this type of analytical investigation and collect from research participants regarding how people felt about the integration process.

Depending on the sorts of data, several data enquiry approaches was used. Quantitative information from primary sources such as questionnaires and secondary sources pallets entered into Excel and SPSS and analyzed as tables. Interviews and written responses from respondents was used to gather qualitative data, then categorize, analyze, and present as narratives.

3.4. Target Population, Sampling Technique & Sample size

3.4.1. Target Population

The population of this study was on major utility services providers; such as Addis Ababa Water and Sewerage Authority, Ethio telecom and Ethio electric Utility in the sub city's branch, Addis Ababa City Road Authority and Addis Ababa City's Infrastructure Development integration team at Construction Permit and Control Authority. The sample frame includes, Managers, Team leaders, Expert and Supervisors, mostly from client side (government), as in the infrastructure industry, it is government organizations, as representative of the target population to gain a typical industry perspective and characteristics on the current state of integration management. The respondents were selected purposively from senior to Director Level, since there are limited number management staffs. The population in number includes 100. Therefore, the population of the study is 100.

3.4.2. Sampling Technique

Sampling involves the selection of a number of study units from a defined study population. .Selecting a sample of individuals hoping that the sample is representative of the population. Convenience sampling technique have been used in this research. From those target population, samples have been selected purposively who have direct and indirect relation with the research issue at Akaki Kality sub city. For both the quantitative and qualitative studies, the researcher employed the targeted group for the study, and the respondents for the key informant interviews were purposefully chosen.

3.4.3. Sample Size Determination

The sample size of the respondents have been determined based on Yemana's formula:

$$n = \frac{N}{1 + Ne^2}$$

N=population which is 100, e=error which is 5% or 0.05.

Therefore, the sample size is calculated as:

$$n = \frac{100}{1 + 100 * 0.05^2}$$

$$n = \frac{100}{1 + 0.25}$$

$$n = 80$$

N=sample size of the respondents. The distribution of the sample among the different organization is also shown in Table 3.1.

Table 3.1: Distribution of samples by organization

Organization	Sample Respondents
Ethio telecom	10
EEPCO	15
AAWSA	15
AACRA	15
MUNICIPALITY	15
Others (consultant, contractors)	10
Total	80

The population of this study was taken from major utility services providers; such as Addis Ababa Water and Sewerage Authority Kality branch, Ethio-telecom and EEPCO Kality branch, Addis Ababa City Road Authority and Addis Ababa City's Infrastructure integration development team of Construction Permit and Control Authority at city level. The sample frame includes Managers Directors, Team leaders, Expert and Supervisors.

3.5. Method of Data Collection

3.5.1. Data Collection

Both primary and secondary data is used in this study.

1. Primary Data

The primary data is gathered by preparing a questionnaire for the concerned parties EEPCO AACRA, Ethio telecom, AAWSA and infrastructure integration development team at city level of Addis Ababa construction permit authority) about the way they use the method in implementing their projects. Also, different sections of departments is interviewed and a questionnaire prepared.

2. Secondary Data

The secondary data is collects from different publications, websites, books journal articles, and internal records of the sectors.

3.5.2. Data Gathering Tools

Data is collects through interviews, spatial analysis and site visits. Questionnaire is prepared to get important information from different perspectives for the coordination and integration problems of utility infrastructures.

The contents of questionnaire are ,organizational structures and coordination's, overall planning and implementation practice, communication strategies and data integrations ,challenges in applying integrated infrastructure management system among each utility provider sector, experience and opinions for developing a systems for better infrastructure integration management on general utility providers.

3.5.2.1. Semi Structured Interview

The research have semi structure interviews to obtain detailed research-relevant information i.e. explore issues related to challenges in applying integration management system among utilities service provider organizations, Road authority and infrastructure regulatory authority. It also

provide much more detail information than what was expected through other data collection methods, a list of questions surveys.

3.5.2.2. Questionnaire

It is planned to use a tool for collecting and recording information about a particular issue of interest, but also included clear instructions and space for answers. Semi-closed and open ended questionnaires were adopted in such away to have quantitative data which related to the objectives of the research, since the research is a mixed research approach. Other relevant data were collected from published and unpublished materials.

The collected data through interviews and spatial analysis was processed, analyze, and summarizes for accuracy and completeness. Then it implicit for analysis so that it can be tabulated for enhanced writing. After writing up and processing the relevant findings, the result was interpreted to derive the relevant conclusion and recommendations. Finally, the research is extracted and draw conclusions with recommendations .A set of analytical software can be used to assist with the analysis of quantitative data (Microsoft Excel and SPSS) and finally, the analyzed data presented accordingly.

3.6. Data Analysis and Presentation

Row data were passed through a process of analysis and interpretation. Accordingly, quantitative data analysis techniques was employed to analyze the data through excel and SPSS. The data from questionnaire were analyzed using descriptive statistics such as frequencies and percentages and presented using tables. The analyzed data presented using statistical tools such as Tables. Relative importance index (RII) have been used to analyze and ranks the data in order to support the data analysis.

3.7. Data Validity and Reliability

3.7.1. Data validity

This study's data must accurately reflect the researcher's scenario, justification, and prediction in order for the study to be deemed legitimate. Internal validity was used to this study's

socioeconomic data, such as respondents' educational attainment levels, work histories, etc. In order to generalize the results of the research to the public, external validity is also considered.

3.7.2. Data Reliability

The test-retest reliability approach was ensured the data reliability of this study. A questionnaire able to out to a sample population of senior and above professionals. The reliability was determined by the interview and questioner responses from those respondents.

Table 3.2 Reliability test analysis

Variables	Cronbach's Alpha	N of Items
Organizational Structure & Coordination in IIMS	.986	10
Communications Strategy in IIMS	.981	11
Planning, design and integration in IIMS	.970	8
Challenges in applying IIMS	.984	9

Source, own survey generated from SPSS (2024)

The reliability analysis shows that the four variables are all highly reliable, with Cronbach's alphas ranging from .970 to .986. This means that the items within each variable are all measuring the same thing, and that the variables are all stable and consistent.

Cronbach's alpha is a measure of internal consistency, which is the extent to which the items on a scale all measure the same thing. A high Cronbach's alpha indicates that the items on a scale are all highly correlated with each other, which means that they are all measuring the same thing. A low Cronbach's alpha indicates that the items on a scale are not highly correlated with each other, which means that they are not all measuring the same thing.

In this case, the Cronbach's alphas for all four variables are high, which indicates that the items on each variable are all highly correlated with each other. This means that the variables are all measuring the same thing, and that they are all reliable.

This is important because it means that the results of the study can be trusted. If the variables were not reliable, then the results of the study would not be meaningful. However, because the variables are reliable, the results of the study can be trusted.

3.8. Ethical Consideration

Basics ethical consideration was applied during data collection, data analyzing and interpreting the result. Such as during data collection wearing similar to the respondent, respecting and appreciate their feedback, keeping the confidentiality of response; during data analyzing accepting the result without any amendment; at interpretation clearly state what the variable are trying to tell.

CHAPTER FOUR

4. DATA PRESENTATION AND ANALYSIS

4.1. Introduction

The table shows the distribution of surveys, the number of surveys returned, the number of valid surveys, and the validity percentage for each section. The total number of surveys distributed was 80, and the total number of valid surveys was 70. This gives a response rate of 88%. The section with the highest validity percentage was Ethio telecom Kality district, with a validity percentage of 13%. The section with the lowest validity percentage was others (consultant, contractors), with a validity percentage of 9%.

Table 4.1 Questionnaire valid response rate

No	Section	Distributed	Returned	Valid	Validity (%)from total
1	Ethio telecom Kality district	10	9	9	13%
2	EEPCO Kality district	15	14	13	19%
3	AAWSA Kality district	15	13	13	19%
4	AACRA	15	14	13	19%
5	MUNICIPALITY	15	14	13	19%
6	Others (consultant, contractors)	10	9	9	13%
	Total	**80**	**73**	**70**	88%

Source, own survey (2024)

4.2. Demographic background of respondents

Regarding to type of respondent's organization, the type of origin of organization and the frequency of each type is shown in Table 4.2. The most common type of organization is

AACRA, with 13 organizations, or 19% of the total. The second most common type of organization is AAWSA Kality district, with 13 organizations, or 19% of the total. The third most common type of organization is EEPCO Kality district, with 13 organizations, or 19% of the total. The fourth most common type of organization is Ethio - Telecom district, with 9 organizations, or 13% of the total. The fifth most common type of organization is Municipality, with 13 organizations, or 19% of the total. The sixth most common type of organization is consultant and contractors, with 9 organizations, or 13% of the total.

Regarding the type of respondent's, the table shows the educational status and level of 70 people. 0% of the people have an educational status below 12 grade, 11% have a diploma, 54% have a degree (1st), and 34% have a master's degree or above. The most common educational status is a degree (1st), followed by a master's degree or above. The least common educational status is below 12 grade. The table shows that the majority of people have a high level of education. This is likely due to the fact that the people in the table are likely to be professionals or students.

Regarding to the type of respondent's, the table shows the primary areas of work of a group of people, along with the frequency and percentage of each area. The most common area of work is Office Expert, with 24 people, or 34% of the group. The least common area of work is Construction, with 8 people, or 11% of the group. The other two areas of work, Design and Operation and Maintenance, have 18 people each, or 26% of the group. Overall, the table shows that the most common areas of work for this group of people are Office Expert and Design. The least common area of work is Construction.

The table shows the number of people with different years of experience in a particular field. The most common number of years of experience is 6-10, with 30 people reporting this. The least common number of years of experience is above 20, with no people reporting this. The table also shows the percentage of people with each number of years of experience. The percentage of people with 0-5 years of experience is 26%. The percentage of people with 6-10 years of experience is 43%. The percentage of people with 11-15 years of experience is 26%. The percentage of people with 16-20 years of experience is 6%. The percentage of people with above 20 years of experience is 0%. Overall, the table shows that the most common number of years of

Table 4.2 Demographic background of respondents

Type of origin of organization	**Frequency**	Percentage
AACRA	13	19%
AAWSA Kality district	13	19%
EEPCO Kality district	13	19%
Ethio - Telecom district	9	13%
Municipality	13	19%
consultant and contractors	9	13%
Total	70	100%
Educational status/Level	**Frequency**	Percentage
Below 12 grade	0	0%
Diploma	8	11%
Degree (1st)	38	54%
Masters and above	24	34%
Total	70	100%
Primary area of work	**Frequency**	Percentage
Design	18	26%
Construction	8	11%
operation and maintenance	20	29%
Office Expert	24	34%
Year of Experience	**Frequency**	Percentage
0-5.	18	26%
6-10.	30	43%
11-15.	18	26%
16-20.	4	6%
above 20	0	0%
Total	70	100%
Position	**Frequency**	Percentage
Architect	18	26%
Engineer	36	51%
Team leader	6	9%
supervisor	6	9%

project manager	4	6%
Total	70	100%
Area of Expertise	**Frequency**	Percentage
Design	24	34%
Construction	18	26%
office work	12	17%
Cad and GIS	6	9%
Inspection	10	14%
Total	70	100%

Source, own survey (2024)

experience is 6-10, with 30 people reporting this. The least common number of years of experience is above 20.

The table shows the distribution of positions in a company. The most common position is engineer, followed by architect, team leader, supervisor, and project manager. Accordingly, the percentage of each position is architect: 26%, engineer: 51%, team leader: 9%, supervisor: 9%, and project manager: 6%. The table shows that the company has a large number of engineers, followed by

Architects, team leaders, supervisors, and project managers. This suggests that the company is a technology company, as engineers are typically the most common position in technology Companies. The table also shows that the company has a relatively small number of team leaders, supervisors, and project managers. This suggests that the company is a relatively flat organization, with a small number of managers.

The table shows the frequency and percentage of each area of expertise. The most common area of expertise is design, with 24 instances, followed by construction with 18 instances. The least common area of expertise is inspection, with 10 instances. The table can be analyzed in a number of ways. One way is to look at the percentage of each area of expertise. This shows that design is the most common area of expertise, followed by construction. This suggests that there is a high demand for people with expertise in design and construction. Another way to analyze the table is

to look at the difference between the frequencies of each area of expertise. This shows that there is a large difference between the frequencies of design and construction, and the frequencies of the other areas of expertise. This suggests that there is a much higher demand for people with expertise in design and construction than for people with expertise in the other areas. The table can also be analyzed by looking at the total number of instances. This shows that there are a total of 70 instances. This suggests that there is a large demand for people with expertise in the areas listed in the table

OBJECTIVE ONE: To assess the current practices of implementation of integrated infrastructure management in Addis Ababa, Akaki Kality sub city.

From the first objectives analysis it is easily observable to see the practice of integrated infrastructure management in the sub city. Even though the city administration have an interest on the problem and there is an effort to work on the problem but it is far to see the result.

4.3. Descriptive Statistics

4.3.1. Quantitative analysis

Based on the table, it appears that the majority of respondents (53%) agree that the Addis Ababa Infrastructure Integration Authority (AAIIA) and their organization coordinate well with other utility providers. Additionally, 54% of respondents agree that the AAIIA organizes all utility companies in order to facilitate and authorize construction projects, designs, and plans. However, only 3% of respondents agree that the AAIIA has a high degree of legal binding.

The organizational structure of the respondents' companies appears to be well-defined, with 55% of respondents agreeing that their company's organizational structure clearly defines project management team roles and responsibilities. Additionally, 54% of respondents agree that their

Company’s organizational chart clearly shows project performance reporting levels and communication channels, the decision making levels within the organization.

Additionally, 51% of respondents agree that their organization has established relationships with stakeholders within the organization in solving the root cause for the problems of the integrated infrastructure project implementation.

Table 4.3 Analysis of organizational structure and coordination

No.	**1. organizational structure and coordination**	1	2	3	4	5	RII
1.1	How would you rate the Addis Ababa Infrastructure Integration Authority's and your organization's coordination with other utility providers?	8	20	36	2	4	53%
		11%	29%	51%	3%	6%	
1.2	Does the newly formed Addis Ababa Infrastructure Integration Authority organize all utility companies in order to facilitate and authorize construction projects, designs, and plans?	2	28	34	2	4	54%
		3%	40%	49%	3%	6%	
1.3	What degree of legal binding does the newly formed Addis Ababa Infrastructure Integration Authority have?	2	28	34	6	0	53%
		3%	40%	49%	9%	0%	
1.4	Does the organizational structure of your company clearly define project management team roles and responsibilities?	2	24	36	6	2	55%
		3%	34%	51%	9%	3%	
1.5	Does the organizational chart clearly shows project performance reporting levels and communication channels, the decision making levels within the organization?	4	24	34	6	2	54%
		6%	34%	49%	9%	3%	
1.6	Is there a focal department or division primarily concerned with new infrastructure development program and rehabilitation and maintenance works?	8	18	30	10	4	55%
		11%	26%	43%	14%	6%	
1.7	What is the level of your organization in performing strategic relationships with other utility providers, Addis Ababa Road Authority and Addis Ababa Infrastructure Integration Authority	2	40	18	8	2	51%
		3%	57%	26%	11%	3%	
1.8	How well your organization has established relationships with stakeholder within the organization in solving the root cause for the problems of the integrated infrastructure project implementation?	4	40	18	4	4	50%
		6%	57%	26%	6%	6%	
1.9	How do you rank the current effort to develop a central data base system among your organization and utility providers?	0	24	36	8	2	57%
		0%	34%	51%	11%	3%	

1.10	Does your organization take the responsibility for any loss in infrastructure relocation?	2 3%	26 37%	32 46%	6 9%	4 6%	55%

Source, own survey (2024)

However, only 57% of respondents agree that their organization takes the responsibility for any loss in infrastructure relocation.

Overall, the results of this survey suggest that the AAIIA is working well to coordinate with other utility providers and to organize utility companies in order to facilitate and authorize infrastructure construction projects. Additionally, the organizational structure of the respondents' companies appears to be well-defined, and the respondents' organizations have established relationships with stakeholders within the organization. However, there is room for improvement in terms of the AAIIA's legal binding and in terms of the respondents' organizations' willingness to take responsibility for any loss in infrastructure relocation.

The first question is about how far your organization is develop and submit proposals, budgets, and implementation plans to Addis Ababa Infrastructure Integration Authority. The results show that 53% of respondents agree or strongly agree that their organization does this. This is a good sign, as it suggests that organizations are taking the necessary steps to ensure that their infrastructure projects are well-planned and coordinated.

The second question is about the level of integration of your organization with other utility providers. The results show that 57% of respondents agree or strongly agree that their organization is integrated with other utility providers at the planning stage, 49% at the construction stage, and 49% at the operation and maintenance stage. This is a positive finding, as it suggests that organizations are working together to improve the efficiency and effectiveness of infrastructure delivery.

The third question is about how far your organization uses the structural plan of the city for new development. The results show that 60% of respondents agree or strongly agree that their organization uses the structural plan of the city for new development. This is a good sign, as it

suggests that organizations are taking into account the long-term needs of the city when planning new infrastructure projects.

The fourth question is about whether your organization incorporates an integrated infrastructure management tools (like Google map and GIS) and central infrastructure database system in planning and budgeting process. The results show that 58% of respondents agree or strongly agree that their organization does this. This is a positive finding, as it suggests that organizations are using technology to improve the efficiency of infrastructure planning and budgeting.

The fifth question is about whether your organization assess the existing population settlement (right of way) in new utility development, rehabilitation and maintenance. The results show that 54% of respondents agree or strongly agree that their organization does this. This is a good sign, as it suggests that organizations are taking into account the needs of the community when planning new infrastructure projects.

The sixth question is about whether there is any detection mechanism for underground utilities by using detection equipment's, without digging, and determining the location of pipes and cables. The results show that 46% of respondents agree or strongly agree that there is such a mechanism in place. This is a positive finding, as it suggests that organizations are taking steps to avoid costly and disruptive excavation work.

Overall, the results of this survey suggest that there is a good level of planning and coordination of infrastructure projects in Addis Ababa. Organizations are taking into account the needs of the city, the community, and other utility providers when planning new projects. They are also using technology to improve the efficiency of infrastructure planning and budgeting. There is still room for improvement, however, particularly in the area of detection mechanisms for underground utilities the table shows the results of a survey on the communication strategy and data integration of an organization. The survey was conducted with 80 respondents, and the results are shown in the table.

The first question asked how efficient the organization is in communicating with other utility providers and Addis Ababa Infrastructure Integration Authority in planning, design, and construction and operation stage. The results show that the organization is most efficient in

Table 4.4 Analysis of overall planning, design and implementation practice

	2.Overall planning, design and implementation practice	1	2	3	4	5	RII
2.1	How far your organization is develop and submit proposals, budgets, and implementation plans to Addis Ababa Infrastructure Integration Authority?	2	24	40	4	0	53%
		3%	34%	57%	6%	0%	
2.2	What is the level of integration of your organization with other utility providers?						
2.2.1	planning stage	4	18	32	16		57%
		6%	26%	46%	23%	0%	
2.2.2	At construction stage	2	22	34	12		56%
		3%	31%	49%	17%	0%	
2.2.3	At operation and maintenance stage	2	44	14	10		49%
		3%	63%	20%	14%	0%	
2.30	How far your organization uses the structural plan of the city for new development?	0	18	34	18	0	60%
		0%	26%	49%	26%	0%	
2.40	Does your organization incorporate an integrated infrastructure management tools (like Google map and GIS) and central infrastructure database system in planning and budgeting process?	0	30	18	22	0	58%
		0%	43%	26%	31%	0%	
2.50	Does your organization assess the existing population settlement (right of way) in new utility development, rehabilitation and maintenance?	0	26	38	6	0	54%
		0%	37%	54%	9%	0%	
2.60	Is there any detection mechanism for underground utilities by using detection equipment's, without digging, and determining the location of pipes and cables?	12	32	18	8	0	46%
		17%	46%	26%	11%	0%	

Source, own survey (2024)

communicating with other utility providers in the planning stage (52%), followed by the design stage (43%). The organization is least efficient in communicating with other utility providers in the construction and maintenance stage (37%).

The second question asked how routinely the organization shared information about current or planned utility services and results with project beneficiary and other stakeholders. The results show that the organization is most routine in sharing information with project beneficiaries in the planning stage (46%), followed by the design stage (46%). The organization is least routine in sharing information with project beneficiaries in the construction and maintenance stage (34%).

The third question asked what communication tool is used among all utility providers for an integrated infrastructure project management. The results show that the most common communication tool is email (51%), followed by formal meetings (43%). The least common communication tool is formal letters (9%).

The fourth question asked at what stage the organization communicates with other utility providers. The results show that the organization communicates most with other utility providers in the planning stage (58%), followed by the design stage (55%). The organization communicates least with other utility providers in the construction and maintenance stage (43%).

Overall, the results of the survey show that the organization is most efficient in communicating with other utility providers in the planning stage, followed by the design stage. The organization is least efficient in communicating with other utility providers in the construction and maintenance stage. The organization is most routine in sharing information with project beneficiaries in the planning stage, followed by the design stage. The organization is least routine in sharing information with project beneficiaries in the construction and maintenance stage. The most common communication tool used by the organization is email, followed by formal meetings. The organization communicates most with other utility providers in the planning stage, followed by the design stage.

The results of the survey can be used to improve the organization's communication strategy and data integration. For example, the organization could focus on improving its communication with Other utility providers in the construction and maintenance stage. The organization could also focus on increasing the routine of its information sharing with project beneficiaries in the construction and maintenance stage. Finally, the organization could consider using other communication tools, such as formal letters or websites, to improve its communication with other utility providers.

Table 4.5 Analysis of communication strategy and data integration

No.	**3.Communication strategy and data integration**	1	2	3	4	5	RII
3.10	How efficient is your organization in communicating with other utility providers and Addis Ababa Infrastructure Integration Authority in planning, design, and construction and operation stage?	4	28	30	8	0	52 %
		6%	40%	43%	11%	0%	
3.20	How routinely your organization shared information about current or planned utility services and results with project beneficiary and other stakeholders.	4	32	32	2	0	49 %
		6%	46%	46%	3%	0%	
3.3	What communication tool is used among all utility providers for an integrated infrastructure project management?						
3.3.1	Formal letter	0	6	40	24	0	65 %
		0%	9%	57%	34%	0%	
3.3.2	Formal meetings	2	30	20	18	0	55 %
		3%	43%	29%	26%	0%	
3.3.3	Email	6	36	24	4	0	47 %
		9%	51%	34%	6%	0%	
3.3.4	Telephone	6	18	30	16	0	56 %
		9%	26%	43%	23%	0%	
3.3.5	Website	8	40	14	8	0	46 %
		11%	57%	20%	11%	0%	
3.4	At what stage does the organization communicate with other utility providers?						
3.4.1	At planning stage	2	22	26	20	0	58 %
		3%	31%	37%	29%	0%	
3.4.2	At design stage	2	24	32	12	0	55 %

		3%	34%	46%	17%	0%	
3.4.3	At construction and maintenance stage	0	22	30	18	0	59 %
		0%	31%	43%	26%	0%	
3.4.4	At operation stage	0	36	28	6	0	51 %
		0%	51%	40%	9%	0%	

Source, own survey (2024)

OBJECTIVE TWO .To identify the challenges in implementing an integrated infrastructure management in Akaki Kality sub city.

The table shows the challenges in applying integrated infrastructure management system among utility providers. The most common challenge is the limitation of organization capability in terms of system, technology, and strategies. This is followed by the lack of common communication platform among sectors, the lack of central database system for data & information exchange, planning and decision-making, and the complexity of the project under construction. Other challenges include the shortage of right of way due to old settlement (without plan) of the city, the lack of understanding the existing structural plans, the repeated modifications of utility plans, the existence of previously installed underground structures, and the negligence of the utility providers for the consequence of non-integrated implementation.

Table 4.6 Challenges in applying integrated infrastructure management system

No.	Challenges in Applying Integrated infrastructure Management System among utility providers.	1	2	3	4	5	RII
1	Limitation of organization capability in terms of system ,technology and strategies	0	0	4	30	36	89%
		0%	0%	6%	43%	51%	
2	Lack of common communication platform among sectors	0	2	14	24	30	83%
		0%	3%	20%	34%	43%	
3	Lack of central database system for data & information exchange , planning and decision-making	0	8	10	36	16	77%
		0%	11%	14%	51%	23%	

4	Complexity of the project under construction	0	6	10	36	18	79%
		0%	9%	14%	51%	26%	
5	Shortage of right of way due to old settlement (without plan)of the city	0	10	14	24	22	77%
		0%	14%	20%	34%	31%	
6	Lack of understanding the existing structural plans	2	2	20	20	26	79%
		3%	3%	29%	29%	37%	
7	Repeated modifications of utility plans	2	4	10	28	26	81%
		3%	6%	14%	40%	37%	
8	Existence of previously installed underground structures	0	8	6	30	26	81%
		0%	11%	9%	43%	37%	
9	Negligence of the utility providers for the consequence of non-integrated implementation	2	2	14	30	22	79%
		3%	3%	20%	43%	31%	

Source, own survey (2024)

The table also shows the relative importance of each challenge. The most important challenge is the limitation of organization capability in terms of system, technology, and strategies. This is followed by the lack of common communication platform among sectors, the lack of central database system for data & information exchange, planning and decision-making, and the complexity of the project under construction. Other challenges are relatively less important.

The table provides useful information for utility providers who are considering implementing an integrated infrastructure management system. The information can help providers to identify the challenges that they are likely to face and to develop strategies to address these challenges.

Based on mean: Integrated infrastructure management systems (IIMS) are designed to improve the efficiency and effectiveness of infrastructure management by providing a single platform for data collection, analysis, and reporting.

Limitation of organization capability in terms of system, technology, and strategies. IIMS require a significant investment in both hardware and software, as well as the development of new processes and procedures. This can be a major barrier for organizations that are already

struggling to meet their current obligations. The mean and standard deviation for this is 3.5714 and .9258 respectively.

Lack of common communication platform among sectors. IIMS rely on the ability to share data and information across different departments and organizations. However, this can be difficult if there is no common communication platform in place. This can lead to duplication of effort, errors, and delays. The mean and standard deviation for this is 3.6714 and .9886 respectively.

Lack of central database system for data & information exchange, planning and decision-making. IIMS need to be able to access and integrate data from a variety of sources, including asset management systems, GIS, and financial systems. This can be difficult if there is no central database system in place. This can lead to data silos, which can make it difficult to get a complete picture of the infrastructure. The mean and standard deviation for this is 3.7000 and 1.0122 respectively.

Complexity of the project under construction. IIMS are often implemented as part of large-scale infrastructure projects. These projects can be complex and involve a number of different stakeholders. This can make it difficult to coordinate the implementation of IIMS and ensure that all stakeholders are on board. The mean and standard deviation for this is 3.5286 and .9886 respectively.

Shortage of right of way due to old settlement (without plan) of the city. In some cases, there may be a shortage of right of way for new infrastructure due to the presence of old, unplanned settlements. This can make it difficult to install new infrastructure and can also lead to delays and cost overruns. The mean and standard deviation for this is 3.5286 and .8634 respectively.

Lack of understanding the existing structural plans. In some cases, there may be a lack of understanding of the existing structural plans for a city. This can make it difficult to plan for new infrastructure and can also lead to delays and cost overruns. The mean and standard deviation for this is 3.4143 and .9245 respectively.

Repeated modifications of utility plans. Utility plans are often modified over time, which can make it difficult to keep IIMS up-to-date. This can lead to errors and can also make it difficult to

track the location of infrastructure. The mean and standard deviation for this is 3.5286 and 1.0456 respectively.

Existence of previously installed underground structures. In some cases, there may be existing underground structures that were not properly documented. This can make it difficult to install new infrastructure and can also lead to damage to existing infrastructure. The mean and standard deviation for this is 3.5429 and .9881 respectively.

Negligence of the utility providers for the consequence of non-integrated implementation. In some cases, utility providers may not be aware of the consequences of not implementing IIMS. This can lead to delays, cost overruns, and safety hazards. The mean and standard deviation for this is 3.4429 and .9575 respectively.

OBJECTIVE THREE. To develop a system that will enable for sustainable infrastructure integration management in Akaki Kality sub city.

4.3.2.**Qualitative analysis**

In the survey question, as indicated in the appendix section A, open ended questionnaire have been developed and data was gathered from the respected respondents. Accordingly, qualitative data analysis was used to discuss the data of the section to solve the third objective of the research. In this section the generalized, average and processed data have been presented below.

The necessary steps or actions required developing and implementing a system for sustainable infrastructure integration management are as follows:

1. Carry out an extensive evaluation throughout the sub city of Akaki Kality. This includes examining the performance and condition of the current infrastructure, determining what the community or area's present and future needs are, and evaluating how the current infrastructure affects the environment, society, and economy.
2. Define objectives and goals related to sustainability. This includes establishing quantifiable, explicit goals for sustainability in the social, environmental, and economic spheres, and aligning these objectives with national, regional, or municipal frameworks and policies for sustainability.

3. Create a plan for integrating sustainable practices, materials, and technologies into the infrastructure. This includes determining whether opportunities there are to include these sustainable practices, materials, and technologies, and developing a plan for how they will be implemented.
4. Involve important stakeholders and look for collaboration throughout the sub city as well as the capital city. This includes involving key stakeholders, such as legislators, local residents, business leaders, and environmental organizations, encouraging cooperative alliances to maximize funds, resources, and experience, and assuring the involvement and support of stakeholders at every stage of the procedure.
5. Put pilot programs and efforts for demonstration into action. This includes initiating modest pilot initiatives to verify and assess sustainable solutions, tracking the results and getting input to improve the strategy, and highlighting effective pilot projects to generate interest and show that integrating sustainable infrastructure is feasible.
6. Create a thorough implementation strategy that outlines the staged approach to implementing the sustainable infrastructure integration throughout the system. This includes determining the resources that are required, such as finance, infrastructure, and labor force capacity, defining roles and responsibilities for execution and creating a governance framework.
7. Constantly assess, analyze, and adjust. This includes establishing strong frameworks for monitoring and evaluating the implementation of sustainable infrastructure in order to measure its impact and performance.

Clear integration standards, protocols, and governance processes can be established to ensure consistency and efficiency across the infrastructure integration management. This includes adopting an established integration standard or the organization Integration Patterns to provide a unified and mutually compatible integration strategy, providing a uniform data format so that information can be shared between various systems, putting in place a standard authentication and authorization system to secure the integration endpoints, establishing a standard approach for managing exceptions and handling errors to guarantee consistent troubleshooting and reporting of errors, using commonly used integration protocols to enable smooth system connectivity, verifying that the integration protocols chosen are compatible with the organization's current and future technological stacks, establishing a strong message queuing and event-driven routine to

increase scalability and isolate the integration components, and using streaming protocols to facilitate real-time data transmission between systems.

A specific integration governance team or council should be created to be in charge of creating and implementing the integration standards, protocols, and governance processes. This team should be responsible for developing and maintaining the integration strategy, ensuring that the integration standards and protocols are followed, and resolving any integration issues that may arise.

4.4. Data Discussion

The document provides insights into integrated infrastructure management in Addis Ababa, particularly in the Akaki Kality sub-city. Key findings include:

Organizational Structure and Coordination: Coordination between the Addis Ababa Infrastructure Integration Authority (AAIIA) and other utility providers is generally good, but stronger institutional frameworks are needed.

Planning, Design, and Implementation Practices: There is a good level of planning and coordination, with prevalent use of technology like GIS.

Communication and Data Integration: Communication is most efficient during the planning stage but less so during construction and maintenance.

Challenges: Key challenges include limitations in organizational capabilities, lack of a common communication platform, and absence of a central database system.

4.5. Summary of Results

The city's regulatory authority is trying to integrate those utility providers, the research finding reveals that the regulatory authority's current institutional capacity has a lack of organizational structure, skilled man power and low technological support and facilitate for decision making, planning and coordination with . Despite the fact that delivery of infrastructure has been difficult due to the high levels of unpredictability, complexity, lack of integration among institutions and stakeholders, urgency, and inadequate planning frequently associated with them, several literature and empirical studies have noted this. Their effects resulted in an increase in the frequency of road

and walk way side damage, significant resource waste, and negative socioeconomic effects on the sub city.it might be good for the Akaki kality sub city that efforts to improve integrated infrastructure management are evident, but significant challenges remain. Progress has been made in coordination, but stronger legal frameworks and better technology integration are needed

Model for better IIMS:

Here are some possible mechanisms to be applied in the implementation of an integrated infrastructure management system (IIMS):

Institutional Mechanisms:

Central Coordinating Body (CCB): Establish in the Sub City a dedicated committee or office with representatives from all relevant infrastructure service providers (water, electricity, transportation, etc.), government agencies (urban planning, finance), and potentially the community. This body would oversee IIMS implementation, fostering communication and collaboration between different stakeholders and ensuring alignment with overall urban development plans.

Memorandums of Understanding (MoUs): Develop MoUs between different infrastructure service providers to outline clear roles and responsibilities within the IIMS framework. These MoUs should define data sharing protocols, joint planning procedures, and conflict resolution mechanisms.

Standardized Data Formats and Protocols (SDFP): Implement standardized data formats and protocols for collecting, storing, and sharing infrastructure data across different agencies. This ensures data compatibility and facilitates streamlined analysis for informed decision-making.

Technical Mechanisms:

Integrated Information Platform (IIP): Develop a central platform that integrates data from various infrastructure sectors, including physical asset information, maintenance history, sensor data, and real-time performance metrics. This platform should be accessible to authorized personnel across agencies and provide user-friendly data visualization tools.

Geographic Information Systems (GIS): Utilize GIS technology to create a spatial map of the entire infrastructure network in Akaki Kality sub city. This allows for visualization of infrastructure assets, their interdependencies, and potential areas of conflict during planning and maintenance activities.

Building Information Modeling (BIM): Consider implementing BIM for new infrastructure projects. BIM creates a digital model of a physical facility with detailed information about its components, which can be integrated with the overall IIMS platform for better lifecycle management.

Process and Workflow Mechanisms:

Joint Planning and Budgeting (JPB): Establish a collaborative process for infrastructure planning and budgeting across different service providers. This ensures all infrastructure needs are considered holistically while optimizing resource allocation.

Standardized Maintenance Procedures (SMP): Develop standardized procedures for infrastructure maintenance activities across different sectors. This reduces inefficiencies, ensures consistent service quality, and facilitates preventative maintenance strategies.

Risk Management Framework (RMF): Implement a risk management framework to identify potential threats to infrastructure systems, assess their likelihood and impact, and develop mitigation strategies. This promotes proactive planning and minimizes disruptions caused by infrastructure failures.

Additional Mechanisms:

Capacity Building and Training (CBT): Provide targeted training programs for infrastructure personnel across different departments to equip them with the skills and knowledge necessary to operate within the IIMS framework. This can include training on data analysis, using the IIMS platform, and understanding IIM principles.

Public-Private Partnerships (PPP): Explore potential partnerships with private entities to leverage their expertise, technology, and financing capabilities in developing and implementing certain aspects of the IIMS.

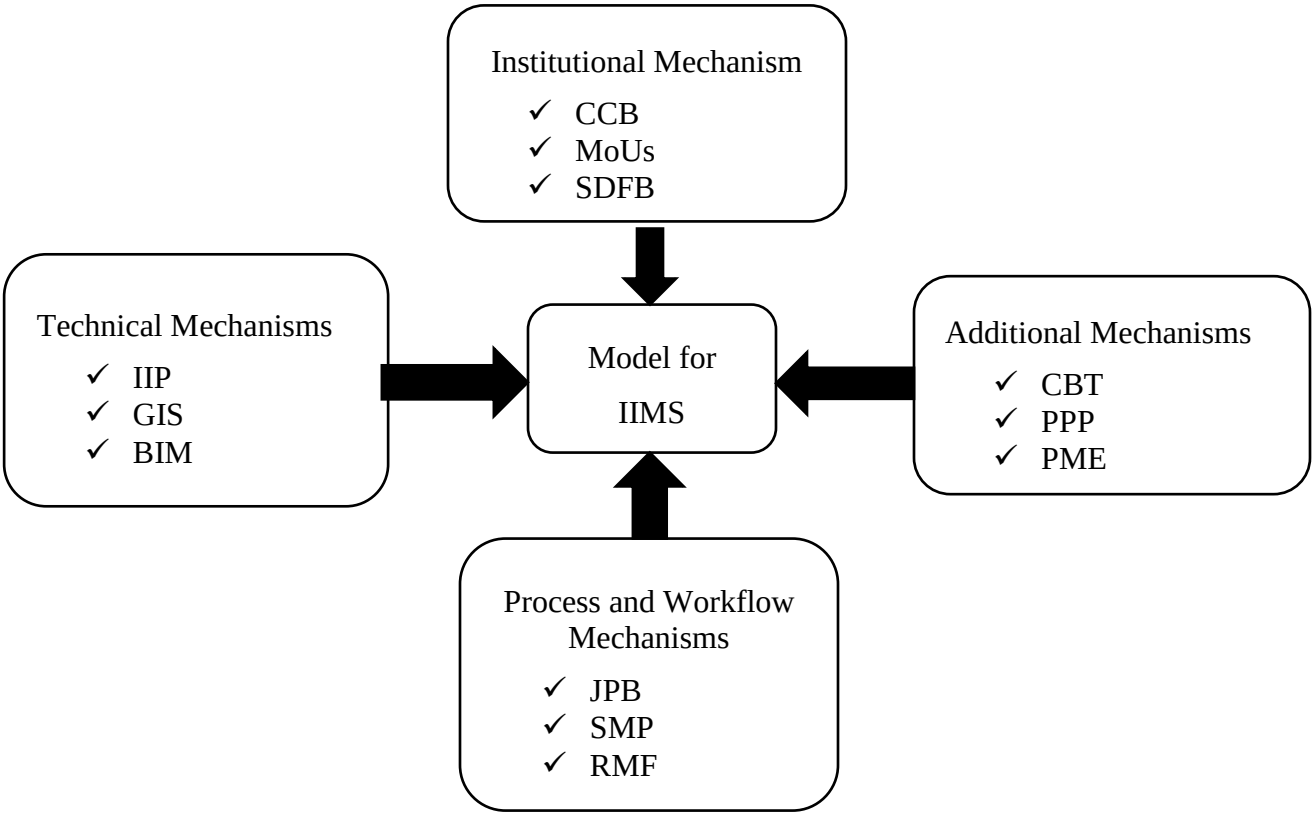

Figure 4.1 Model for best practice of IIMS practice IIMS
Source, own developed model from study findings (2024)

Performance Monitoring and Evaluation (PME): Regularly monitor the performance of the IIMS and evaluate its effectiveness in achieving desired outcomes. This allows for continuous improvement of the system and adaptation to evolving needs.

By implementing a combination of these mechanisms, Akaki Kality can create a more integrated and efficient infrastructure management system, leading to improved service delivery and a more sustainable urban environment.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusions

The study underscores the importance of integrated infrastructure management in Addis Ababa. While there are efforts to improve coordination, significant barriers still exist. Addressing these challenges is crucial for sustainable infrastructure integration management.

- This assessment evaluated the current practices of integrated infrastructure management (IIM) in Akaki Kality sub city, Addis Ababa. The findings revealed the current state of infrastructure management, the level of integration between service providers, and the utilization of technology and data. While there is existing policies or frameworks related to IIM, a fully functional and sustainable system is yet to be fully realized.
- The key challenges identified hindering effective IIM include institutional fragmentation, limited technical expertise and resources, inadequate data management systems, and a lack of stakeholder participation. These challenges create inefficiencies, hinder proactive planning, and ultimately lead to infrastructure issues that negatively impact the sub city's residents and businesses.
- It is necessary to establish a dedicated integration governance team or council to oversee the development and execution of the integration protocols, standards, and governance procedures. This group should be in charge of creating and implementing the integration plan, making sure that the protocols and standards are followed, and resolving any potential problems with integration.

5.2. Recommendations

5.2.1. Recommendations for improvement

Based on the finding and conclusions of the study, the following recommendations have been forwarded:

Enhance Communication and Data Integration: Develop a common communication platform and centralized database system.

Invest in Capacity Building and Technological Solutions: Upgrade systems, technologies, and strategies.

Prioritize Integrated Planning and Implementation: Ensure coordinated and integrated planning and implementation.

Promote Stakeholder Engagement and Public Awareness: Engage with the community and stakeholders to raise awareness and incorporate feedback.

To address these challenges and build a sustainable IIM system in Akaki Kality, the following recommendations are proposed:

Strengthen Institutional Coordination: Establish a central coordinating body with representatives from all relevant infrastructure service providers, government agencies, and the community. This body will be responsible for overseeing IIM implementation, fostering communication and collaboration, and ensuring alignment with overall urban development plans. Empower AAIIA with stronger legal binding and enforcement mechanisms.

Capacity Building and Training: Provide targeted training programs for infrastructure personnel across different departments to enhance technical skills, knowledge of IIM principles, and data analysis capabilities. This will allow for a more knowledgeable and efficient workforce equipped to manage infrastructure effectively.

Data Management and Information Sharing Platform: Develop a comprehensive data management system that integrates data from different infrastructure sectors. This system should

be accessible to authorized personnel across agencies and provide real-time data on infrastructure performance, maintenance needs, and potential risks.

Stakeholder Engagement and Public Participation: Implement strategies for regular communication with stakeholders, including residents, businesses, and community leaders. This could involve public forums, workshops, and accessible communication channels to inform citizens about infrastructure projects, potential disruptions, and seek their input to ensure project implementation aligns with their needs.

Phased Implementation: Develop a phased implementation plan for the IIM system, starting with pilot projects in specific areas to test and refine the model before full-scale deployment. This allows for adjustments based on lessons learned and demonstrates the system's effectiveness before broader adoption.

5.2.2. Further Research

This assessment provides a valuable starting point for building a sustainable IIM system in Akaki Kality. Further research could explore deeper into specific areas, including:

Cost-benefit analysis: Conducting a cost-benefit analysis of implementing the proposed IIM system to assess its financial feasibility and potential return on investment.

Adapting best practices: Exploring successful IIM strategies from other developing cities and adapting them to the unique context of Addis Ababa.

Public-private partnerships: Investigating the potential for public-private partnerships in financing and developing innovative infrastructure solutions within the IIM framework.

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APPENDIXES

Appendix A: Questionnaire

Dear respondent

At Addis College, I'm conducting research for my master's degree. I am grateful for your insightful suggestions in advance. The study's objectives are to assess the practices in applying the integration of infrastructure management system among Addis Ababa, Akkaki kality sub city and to provide possible integrated infrastructure implementation mechanisms. This survey is exclusively utilized for educational purposes.

You can Contact me:

Beza Abera Tel. no +251- 911-175110 email - bezabreg@gmail.com

Part I: General Information about Respondents

Instruction: Please put "√" mark on the space provided to indicate your response where applicable.

Part I: General Information about Respondents

1.1 Type or origin of your organization

□ AACRA □ AAWSA □ EELPA □ Ethio-telecom □ Municipality □ others (please specify) ----------

1.2 What is your primary area of work?

□ Design □ construction □ operation and maintenance

□office expert □ others (please specify) ----------

1.3 Your year of experience? .....

1.4 Educational status? .....

1.5 Position.....

1.6 Area of expertise.....

<u>Part II</u>: The practices of implementation of integrated infrastructure management system in Addis Ababa, Akaki Kality sub city.

Instruction: the items in this question have a five (5) level Likert;

Please, put a (√) mark on the point you think the awareness is appropriate

No.	**Section 1 : Organizational Structure & Coordination**	Answering				
		S (4)	G (3)	W (2)	P (1)	NA (0)
1	How would you rate the Addis Ababa Infrastructure Integration Authority's and your organization's coordination with other utility providers?					
2	Does the newly formed Addis Ababa Infrastructure Integration Authority organize all utility companies in order to facilitate and authorize construction projects, designs, and plans?					
3	What degree of legal binding does the newly formed Addis Ababa Infrastructure Integration Authority have?					
4	Does the organizational structure of your company clearly define project management team roles and responsibilities?					
5	Does the organizational chart clearly shows project performance reporting levels and communication channels, the decision making levels within the organization?					

6	Is there a **focal department or division** primarily concerned with new infrastructure development program and rehabilitation and maintenance works?					
7	What is the level of your organization in performing **strategic relationships** with other utility providers, Addis Ababa Road Authority and Addis Ababa Infrastructure Integration Authority					
8	How well your organization has **established relationships with stakeholder** within the organization in solving the root cause for the problems of the integrated infrastructure project implementation?					
9	How do you rank the current effort to **develop a central data base system** among AACRA and utility providers?					
10	Does your organization take the responsibility for any loss in infrastructure relocation?					

S= Strong (4), G= Good (3), W=Weak (2), P=Poor (1), NA=Not applicable (0)

Section 3: Communications Strategy and data integration		S (4)	G (3)	W (2)	P (1)	NA (0)
18	How efficient is your organization in communicating with other utility providers and Addis Ababa Infrastructure Integration Authority in planning, design, construction and operation stage?					
19	How routinely your organization shared information about current					

	or planned utility services and results with project beneficiary and other stakeholders.						
20	What communication tool is used among all utility providers for an integrated infrastructure project management?	Formal letter					
		Formal meetings					
		Email					
		Telephone					
		Website					
		Any other please specify…					
21	At what stage does the organization communicate with other utility providers?	At planning stage					
		At design stage					
		At construction and maintenance stage					
		At operation stage					
		Others (specify)…					

Part III: To identify the challenges in implementing an integrated infrastructure management system among the utility service providers in Akaki Kality sub city.

Instruction: the items in this question have a five (5) level Likert;

Please, put a (√) mark on the point you think the awareness is appropriate

S= Strong Agree (5), A= Agree (4), N=Neutral (3), D=Disagree (2), SD=Strongly Disagree (1)

No.	Challenges in Applying Integrated infrastructure Management System among utility providers.	SA (5)	A (4)	N (3)	D (2)	SD (1)
1	Limitation of organization capability in terms of system ,technology and strategies					
2	Lack of common communication platform among sectors					
3	Lack of central database system for data & information exchange , planning and decision-making					
4	Complexity of the project under construction					
5	Shortage of right of way due to old settlement (without plan)of the city					
6	Lack of understanding the existing structural plans					
7	Repeated modifications of utility plans					
8	Existence of previously installed underground structures					
9	Negligence of the utility providers for the consequence of non-integrated implementation					
10	Poor/unfit project delivery approach					

Part IV

Dear respondents

I have prepared questions in an effort to develop and expand upon my comprehension of the circumstances in Addis Ababa, at Akaki Kality Sub City. Only those who are directly involved in the research will be able to access the information you provide, and the content of your response will be kept completely confidential. Giving thank in advance for your precious time and kind co-operation.

Section 1: Open ended Questions/ to develop a system that will enable for sustainable infrastructure integration management in Akaki Kality sub city.

The questions below are aimed to benefit from your experience and opinion in developing a system for sustainable infrastructure integration management on general utility provider organizations. Please briefly answer your opinion:

1. In your opinion, what are the necessary steps or action requires developing and implementing a system for sustainable infrastructure integration management?
   .....
   .....
2. Can you state clear integration standard, protocols and governance process to ensure consistency and efficiency across the infrastructure integration management? With regard to defining data format communication protocols ,security protocols and error handling mechanisms.……
   ……
3. What policy or regulatory frame work need to be in place to support the implementation of sustainable infrastructure integration management?
   .....
   .....
4. What data and monitoring mechanisms should be considered to track the progress and impact of the system
   ……
   …….
5. Are there any specific skills or expertise required for managing sustainable infrastructure integration effectively? If so, what are they?

……

……

Part V: BEST PRACTICES/ Interview questions

1. Could you briefly discuss some of the lessons you've learned about the way infrastructure integration management is now done?

……

……..

2. What are the main advantages, in your opinion, of using technologies and procedures connected to integrated infrastructure management systems?

……

…….

3. What gaps did you identify during integrating the infrastructure regarding the Addis Ababa Infrastructure Integration Permit Control Authority?

……

…….

Appendix B: Analysis Data

Descriptive Statistics			
	N	Mean	Std. Deviation
CH_1	70	4.4571	.60638
CH_2	70	4.1714	.85077
CH_3	70	3.8571	.90547
CH_4	70	3.9429	.86620
CH_5	70	3.8286	1.03520
CH_6	70	3.9429	1.01989
CH_7	70	4.0286	1.00681
CH_8	70	4.0571	.96137
CH_9	70	3.9714	.94748

Descriptive Statistics			
	N	Mean	Std. Deviation
OS_1	70	2.6286	.93517
OS_2	70	2.6857	.82608
OS_3	70	2.7143	.88699
OS_4	70	2.7429	.77433
OS_5	70	2.6857	.82608
OS_6	70	2.7714	1.02394
OS_7	70	2.5429	.84589
OS_8	70	2.4857	.91276
OS_9	70	2.8286	.74155
OS_10	70	2.7714	.87097

Descriptive Statistics			
	N	Mean	Std. Deviation
PD_1	70	2.7143	.78284
PD_2	70	2.8571	.83901
PD_3	70	2.8000	.75373
PD_4	70	2.4571	.77433
PD_5	70	3.0000	.72232
PD_6	70	2.8857	.86045
PD_7	70	2.7143	.61721
PD_8	70	2.3143	.89350

Descriptive Statistics			
	N	Mean	Std. Deviation
CS_1	70	2.6000	.76896

CS_2	70	2.4571	.65244
CS_3	70	3.2571	.60638
CS_4	70	2.7714	.87097
CS_5	70	2.3714	.72575
CS_6	70	2.8000	.89443
CS_7	70	2.3143	.82608
CS_8	70	2.9143	.84687
CS_9	70	2.7714	.76464
CS_10	70	2.9429	.75921
CS_11	70	2.5714	.64989