ADDIS ABABA UNIVERSITY
COLLEGE OF NATURAL SCIENCES
SCHOOL OF INFORMATION SCIENCE

Problems and Challenges on Addis Ababa Land and Infrastructure Management: Towards an Information System Strategy

Fasil Bekele

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Addis Ababa, Ethiopia

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A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Information Science

By

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_____	Advisor	_____	_____
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List of Acronyms

AACG ……. Addis Ababa City government

AACRA …….. Addis Ababa City Roads Authority

AALTC …… Addis Ababa Light Train Corporation

AAWSSA……. Addis Ababa Water Supply and Sewerage Authority

AICD ……... Africa Infrastructure Country Diagnostic

ArcIMS ……. Arc Internet Map Server

CAD …… Computer Aided Design

CGAA ……. City Government of Addis Ababa

CGI …….. Canadian Global Information

DBMS ……. DataBase Management System

DMS …… Document Management System

DMS …… Document Management System

EELPA …… Ethiopian Electric Light and Power Authority

EPCO …….. Ethiopian Electric Power Corporation

ESRI …… Environmental System Research Institute

FIIDCA …… Federal Integrated Infrastructures Development Coordination Agency

GELIS ……. Ground Emitter Locations Identification System

GIS …….. Geographic Information System

HTML ……. Hyper Text Mailing Language

ICT …….. Information Communication Technology

IMS ……. Information Management System

IMS ……. Internet Map Server

INSA …… Information Network Security Agency

ISS …….. Information System Strategy

LIS …….. Land Information System

LRCC …….. Land Records Conversion Center

LRS ……. Linear Referencing System

LUPMIS …….. Land Use Planning and Management Information System

MoST …….. Ministry of Science and Technology

NLIMS …… National Land Information Management System

OSCAR …… Open Source Cadastral And Registry

PHP ……. Hypertext Preprocessor (formerly stood for “Personal Home Page”)

SNG …… Sub National Governments

SVG …… Scalable Vector Graphic

WMS ……... Workflow Management System

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ABSTRACT

Information is a powerful resource in this “information age”. The form and tools to exchange information and data from human civilization and industrial era and to current time is changing drastically. Information system obviously played the vital role here. Most cities and municipalities are currently adopting information technologies in their various activities to achieve their targeted goals and objectives. Addis Ababa City Government, as well, currently launched a GIS based land management information system and using it to register owned land plots of the city. However, the general land and infrastructure management is suffering from different problems and challenges. One of these problems and challenges is the crossing over of infrastructures amongst the infrastructure. This crossing over impedes the development of infrastructures of the city and also incurs a significant lose in different types of resources.

This research attempted to explore and empirically evidence those problems and challenges, the major sources as well and propose an Information System Strategy as a solution. Mixed methods, in which qualitative and quantitative approaches have been employed consecutively in this research with a sequential exploratory strategy. In due course, the problems were found to be renowned and generated basically from lack of exhaustive information about each of the infrastructures, poor and traditional way of communication and information exchange, and self-goal centeredness of the bureaus. Eventually, it is divulged that the problems and challenges of the crossing over can be resolved by formulating and implementing an Information System Strategy. The key findings that the Information System Strategy solution should comprise are acquiring comprehensive information, embracing them before getting in to the physical works, creating integration with other concerned organs including the involvement of both regional and federal governments.

Therefore, from the findings and results of the analysis of the data obtained from informal discussion with the executives and experts in the area, interview and documents review, a high level IS Strategy is proposed and evaluated against utilities it need to posses with the experts in the area and IT professionals in the organizations.

Keywords: problems and challenges, Land and Infrastructure Management, Information System Strategy, ICT usage in Infrastructure Management.

CHAPTER ONE

INTRODUCTION

1.1 Background and Overview

Infrastructures are the vital components for cities in both developed and developing countries. Therefore it needs a proper management with the ever growing behavior of these cities. As Lee et al, (2015) said Infrastructure assets are important national assets directly related to economic growth and quality of life of citizens; they are also important indicators of national competitiveness. Most countries including ours, usually encountered different type of problems and challenges related to their infrastructure assets. For instance, existing infrastructures are showing deterioration from aging and require an increased amount of budget for maintenance, but the problems and challenges are not limited to this. Furthermore, absence of distinctive body for infrastructure management, lack of integration and underutilization of technology are also observed (Nyarirangwe**,** 2008). There is lack of optimal managerial and economic approaches, such as minimization of total asset cost, from a life-cycle perspective and there is no guideline for operational procedures and techniques for asset management Due to this fact different countries have developed infrastructure asset management policies and manuals, like Korea, and some others are also adopting existing global manuals and developing their own (Lee et al, 2015).

Addis Ababa is also undergoing such problems and challenges to have a well-developed infrastructure as it is the capital of Ethiopia and also the "diplomatic capital" of Africa. Due to this fact that the African Union head office and other international organizations are located here. The city is located at the geographical centre of Ethiopia (8º55′–9º05′N and 38º40′–38º50′E) (Yirgalem, 2009). After going through some reformation and restructuring by Proclamation No. 21/2010 provided to amend the Addis Ababa City Government Executive and Municipality Services Organs Re-establishment Proclamation No. 15/2009, the name “kebele” is changed to “woreda” and the number of woredas became 116 while the sub cities are still 10. Despite the fact that the main focus of this research is Challenges and Problems in Land and Infrastructure

Management of Addis Ababa but the land management issues were raised due to the strong relationship it has with both infrastructure development and management.

All countries have to deal with the management of land. Land management has to deal with the four functions of land tenure, land value, land use, and land development in some way or another (Enemark, 2009). Though much has been tried to solve problems in land management, it is yet to find a flawless land management system. Land management, as stated above, includes land development. Land development refers to the processes of implementing land-use planning or development proposals for building new urban neighborhoods and new physical infrastructure and managing the change of existing urban or rural land use through granting of planning permissions and land-use permits (Abebaw, 2017). This implies that land management is closely attached to physical infrastructures, which means with their development, upgrading, expansion and management.

Land is, as know by all, the basic but scarce resource in most urban areas, including Addis Ababa. Thus, it needs proper, economic, wise and persistent management by the responsible organizations, in our case Addis Ababa city government land management bureau and its subsequent offices in the sub cities. According to Urban Land Development and Management Policy and Strategy of Ethiopia (2012), assurance and facilitation of urban growth and development highly needs developing infrastructures and its major input is land. Both in urban expansion and urban renewal areas, Land management bureaus of the city are working closely with infrastructure developing and owning organizations which are responsible for the design, construction, maintenance, upgrading and expansion of infrastructures in the city. The land management bureau and other subsequent offices are using mostly paper based filing system and maps. When we come to the technology, they use an AutoCAD format Arial-photos, which most of them call it “GIS” and a database designed with “visual foxpro” to handle and manage the data about the land plots they possess and/or administer (Ayalew, 2002).

But currently a GIS based and somehow networked (locally) land tenure registration system has come to use in land management bureaus of all sub cities. The efficiency and performance of the system with respect to the experts administering and using the system to deliver land registration related services has to be studied by its own, as so it is not the main concern of this research. But

some issues were discussed with land information management systems with regard to infrastructure management, as the focus of this research is the challenges and problems in land and infrastructures management towards a holistic strategy.

Infrastructure is according to Dictionary.com, the fundamental facilities and systems serving a country, city, or area, as transportation and communication systems, power plants and schools. But the Wikipedia free encyclopedia (2014), defines infrastructure as the fundamental facilities and systems serving a country, city or area, including the services and facilities necessary for its economy to function. It typically characterizes technical structures such as roads, bridges, tunnels, water supply, sewers, electrical grids, telecommunications, and so forth, and can be defined as 'the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions'. Here in our case, the issue in deal is urban infrastructure. The latter source defines Urban Infrastructure as hard infrastructure systems generally owned and operated by municipalities, such as streets, water distribution, and sewers. It may include some of the facilities associated with soft infrastructure, such as parks, public pools, schools, hospitals and libraries. In all of the above definitions the main components of infrastructure are transportation systems, water supply lines, sewer lines, telecommunication grids are the basic ones. The Addis Ababa Roads Authority, Addis Ababa Water Supply and Sewerage Authority, Ethiopian Telecommunication Corporation (Ethio-telecom), Ethiopian Electric Power Corporation (EEPCO) and Addis Ababa Light Train Corporation (AALTC) are the main bureaus who own and administer these basic infrastructures of Addis Ababa.

There are some challenges the Addis Ababa City Government (AACG) encounters while working to the development of the city. When a road is constructed or upgraded by the AACRA another infrastructure either belongs to EEPCO or AAWSSA or Ethio-telecom maybe damaged or dismantled, and either wise. On the other hand, when AACG land management gives some plots to someone, especially in the renewal and upgrading areas, there might be some sort of infrastructure under beneath and while the land plot owner begins excavation for the foundation of the proposed building, the resource beneath might be found which may distract the construction and causes a significant delay for the resolution with the responsible bureaus, which brought lose in time, money and many other resources.

The use of state of the art technologies with regard to information storage and manipulation is not seen exercised in these offices. Lack of integrated way of information storage and exchange method is one of the main sources of these challenges. Another challenge in land and infrastructure management of Addis Ababa is the administrative hierarchy of these bureaus. While the Addis Ababa City Roads Authority (AACRA) and Addis Ababa Water Supply and Sewerage Authority are under the administration of AACG but the other ones like Ethiopian Telecommunication Corporation and Ethiopian Electric Power Corporation are under the federal government of Ethiopia. Since AACG is not authorized on these the latter bureaus, their policies, strategies and plans are somehow far from the reach of the municipality's experts.

Another federal institution called Federal Infrastructure Integration, Development and Coordination Agency (FIIDCA) has been established by a proclamation No. 857/2014 and launched in 2006. Its objective is to coordinate the execution of integrated infrastructure development works, especially by developing formula for the assessment of compensation for properties to be removed, landholdings to be expropriated due to infrastructure developments. Its main focus is major infrastructure projects in the country like Transportation, Energy, ICT and Water. In recent years, according to their broacher, they embarked in implementation of major infrastructure projects of the country including roads, railways, airports, dry ports, power, irrigation, telecom, water and sewage. This infrastructure projects are mostly handled by the federal government and federal institutions and the problems and challenges raised here in this research are not, of course, the focus of FIIDCA. This study is about infrastructures owned and managed by the regional administration level and the problems and challenges usually encountered.

1.2 Problem statement

Municipal infrastructure management is inherently an integrated process that requires the assimilation of a multitude of data, processes, and software systems. Current work practices have resulted in significant process and data fragmentation, which have subsequently created much inefficiency that impede the implementation of effective management strategies (Halfawy, 2008). The Urban Development Policy of Ethiopia (2012), provision of land and infrastructures need to be in an integrated way with the coordination of the City Government and other stakeholders.

The City Government of Addis Ababa and the respective offices found in corresponding sub-cities and other infrastructure owning and administering bureaus areusually blamed for the services they render, specially where they usually crosses over other infrastructure utilities while working on their owns. This is obviously directly related to the land and infrastructure development and management of the city. As stated on the Urban Development Policy of Ethiopia (2012), infrastructure development in urban areas is expected to play the vital role in economic and societal developments. It also states that priority should be given to potable water, road, telecommunication and electric power consecutively. These infrastructure ordering authorities, building or installing, owning and administering the infrastructures in the city also are accountable for the undeveloped infrastructures to the level a metropolitan city would be expected to have. Furthermore for the complications and, economical and societal crisis occurred due to lack of integrity during construction and implementation of these infrastructures.

As the country's infrastructure report by Africa Infrastructure Country Diagnostic (AICD) (2010), published by World Bank reports, though it is still very low when compared to the middle income country peers, the reviews showed a significant boost in growth performance in infrastructure development in the mid 2000s. The report also says "Ethiopia is a predominantly rural country and Addis Ababa, which is in the middle of the country, is by far the largest urban center. Ethiopia's infrastructure backbone development therefore tends to be centered in Addis Ababa and to spread from there outwards. Hence a proper and integrated management in infrastructures of Addis Ababa is vital not only for the city but also the whole country.

The current land and management system in Addis Ababa is not where it needs to be for the city, to plan and implement infrastructures in harmonized manner. To effectively plan, construct, manage, and maintain our transportation assets requires that we first effectively model it using some form of an information system (Hall, 2004). The land information management problems are the problems and challenges of the infrastructure ordering bureaus because each infrastructure development and management is directly related to the land and its information. The drawbacks of the land information of the city is also declared on the Urban Land Development and Management Policy and Strategy of Ethiopia (2012), which are lack of exhaustive information about the urban land, absence of modern system for urban land and tenure registration, integration and coordination of the responsible parties.

Regarding infrastructures, like roads, telecom and internet grids, water supply and sewer collection lines in Addis Ababa are owned and administered by different offices, and some of these offices usually work independently under the federal government while AACRA and AAWSA are standalone authorities in the City Government of Addis Ababa. These bureaus are building and managing the infrastructures they possess regardless of one another. **These practices create the crossing over of infrastructures**, which is the basic problem in infrastructure development and management of the city. Although this crossing over of infrastructures might have variety of causes, in order to eliminate or at least significantly reduce the consequences the major ones should be studied. "*The increasing complexity and sophistication of infrastructure management processes resulted in creating diverse areas of knowledge, expertise, and responsibilities within and across municipal departments (e.g. water, sewer, and road management). As a result, a state of process fragmentation was created, and much inefficiency has subsequently arisen primarily due to the enormous volume of complex information that needs to be generated and exchanged, and the difficulty to streamline and coordinate these inter-dependent processes*" (Halfawy, 2008).

Since there is no well-organized and established information about them, a construction of one usually demolishes or breaks the others. Each bureau responsible for the infrastructures usually needs to retrieve information about the land area where they intend to construct or upgrade their infrastructures. But as the matter of fact, the land administration of the city usually gives them the data that contains only the houses and buildings on the area. As prior study and analysis were not usually made considering other infrastructures above or under the earth where the new infrastructure is to be built or an old one is to be expanded/upgraded, it mostly breaks and damages another. For instance, when a road is to be built, the houses or buildings might be removed with all the necessary accommodations to the owners, but a water supply lines, sewer collection lines and telecommunication grids might be damaged. This phenomenon sometimes may result a conflict between the bureaus and may destruct the ongoing construction of the new road or the expansion (upgrading). This crossing over among infrastructures is usually seen to happen in the city, not only by road construction but also by other infrastructure ordering authorities.

A variety of urban infrastructure and services were considered by researchers in Ethiopian cities which includes specifically physical infrastructures; like road, energy, storm water drainage, water supply and sanitation, green infrastructure, solid waste management infrastructure, ICT infrastructure, and social infrastructure mainly like education and health (Tiwari, 2016). However, these researchers made their researches in some cities of the country depending on their interest and either one of the infrastructures mentioned above were their focuses. Tiwari (2016) also said apart from these, some research investigations were focused on organizational and governance issues such as integration of infrastructures and services, government policies on infrastructure, their challenges and solution. Regarding roads, some scholars were concerned about the provision of the infrastructure in the city. For instance Ahmednur (2009), Shewarega (2009), Mola (2010) and others were concerned about the challenges, opportunities, employability potential and the role of poverty eradication of the currently viable, indigenous material based, labour intensive and environmentally sustainable infrastructure which is a cobble stone pavement roads specially in the interior cities in their researches. Some other researchers like Dereje (2009), Negede (2010) and Fufi (2011) focused on issues of provision and management of road infrastructure, their role in city development, performance of the ordering authority in road maintenance, community participation in planning, construction, maintenance, road safety, economic role of roads, road infrastructures for visually impaired ones. Researches were also made on some other infrastructure types, like energy supply, urban storm water management, water supply and sewerage management, social infrastructures, urban green infrastructures, ICT infrastructures and urban linkage infrastructures. Most covered challenges and problems by these researches were provision of the infrastructures, their quality and unachieved economic and developmental benefits.

A research made by Nyarirangwe, (2008) investigated harnessing the utility of urban infrastructure asset management in Ethiopian cities with respect to challenges and opportunities. The problems explored were inexistence of accurate information of the current stock infrastructures in terms of condition, capacity and level of demand, lack of understanding of how to properly manage infrastructure stocks. These problems were associated with lack of human and financial resource capacity in most of the municipalities. Major institutional transformation, infrastructure detailed inventory, using the GIS and CAD systems for information management and capacity building were the solutions proposed by this researcher.

Actually all the challenges and problems investigated by these researchers were factual in Addis Ababa city. The challenges and problems raised in these researches were: lack of information, lack of capacity, attitude problems, impracticality of the proclamations and laws of implementation.

Hence, the challenges and problems in land and infrastructure management together were not investigated yet, as of the researcher, by any researches. Also the problems of crossing over of infrastructures, how communication and integration amongst land management and other infrastructure ordering bureaus need to be, were not explored. In addition to these, some frameworks and infrastructure management manuals were developed by some researchers (Lee et al.) but an attempt to tackle the problems either with the help of ICT or IS strategy development have not been done yet.

Thus, after analyzing and trying to find out the gaps in earlier researches made on related issues, considering their limitation and future directions, this research is expected to answer the following questions.

1. What are the root causes of the crossing over of infrastructures?
2. How can ICT be used to support the integration and harmonization of Infrastructure Ordering Authorities and Land Management Bureaus?
3. What could be an appropriate IS strategy to address these problems mentioned above?

1.3 Objective of the study

1.3.1 Genera Objective

The main objective of this research is to empirically investigate the problems and challenges in land and infrastructure management of Addis Ababa, and then to propose a solution.

1.3.2 Specific Objectives

The specific objectives of this research are to:-

- Investigate and identify the problems and challenges with their major causes, in land and infrastructure management of Addis Ababa.

- Suggest the way ICT can support integration and harmony amongst the Infrastructure Ordering Authorities and the Land Management Bureaus.
- Propose an Information System Strategy that can be a solution to the problems and challenges.

1.4 Scope and Limitation of the Study

This multiple case study type research is conducted on the land administration bureaus of Addis Ababa and the Addis Ababa Roads Authority (AACRA). It is intended to investigate the problems and challenges in land and infrastructure management of the city. And to pin point the causes of the problems and the challenges related to land and infrastructure management of the city. Specifically problems related to the occurrence of crossing over amongst infrastructures and the challenges encountered for a smooth management is the main focus. The final reach of this research is, after exploring and identifying the challenges and problems with their causes, to develop and propose an Information System Strategy that can help to tackle those problems and challenges in land and infrastructure management of Addis Ababa.

This research is believed to give insight a possible way towards solving the existing and afore coming problems and challenges regarding land and infrastructure management for the Addis Ababa City Administration and other infrastructure administering bureaus. If time and other resources were not scares some more effort should have been exerted and it was preferable if more data from a wider study population is collected for a better understanding and so that the best solution could be proposed. However, with the same reason mentioned above this research is limited to the land administration office of the municipality and Addis Ababa City Roads Authority. Though AAWSSA, EPCO, Ethio-telecom and Addis Ababa Light Train Corporation (AALTC) are other stake holders in the development and management of infrastructures to the city, they were not covered by this research. Other types of infrastructures like parks, schools, health facilities and the likes are also what we call soft infrastructures, but were not included by this research as well.

This research is limited only in proposing a high level Information System strategy, and to suggest the way how the relationship and integration among the land management bureaus and other infrastructure ordering authorities need to be.

1.5 Significance of the study

This research is believed to benefit mainly the nation at large, Addis Ababa City Government and the citizens of Ethiopia. Though the crossing over is visible here and there in the city, the causes, problems and challenges were not studied and stated before. Therefore the Addis Ababa City Government will get a research based and evident list of problems and challenges in the land and infrastructure management of the city. In addition to these, problems and challenges found out by previous studies will be affirmed empirically with data collected from the experts in the organizations. An appropriate optional strategy is proposed for both the city and the nation to solve those problems and challenges. The proposed Information System Strategy will create an insight to the decision makers of the respective bureaus what is needed to be done to tackle the problems and challenges, and what kind of relationship they need to have. It also create conducive working environment for the land management bureaus and infrastructure ordering authorities, if implemented accurately. Some interested system developers and researchers also may find a kickoff point from the suggestion and recommendation of this research.

1.6 Organization of the thesis

This research report contains five main parts labeled as chapter. This first part, chapter one is aimed to give the general picture of the research. It includes an overview of the case city, Addis Ababa, and the problem statement which familiarizes any reader about what is going to be studied and the problem questions. The objective of the study followed by scope and limitations, finally significant of the study comes just before this final section this chapter. There comes the second chapter that reviews literatures considered relevant and includes also most related ones in brief. The third chapter presented the general research approach used and the methodology with techniques and methods. Chapter four is about how the data collection, analysis and interpretation of the data made. It also presents an in-depth discussion about the key findings of the research. The final one, chapter five, summarized the whole research report, proposed and discussed the Information System Strategy solution which is believed to be the main contribution of this research. At the end of the final chapter a conclusion is stated and further recommendations were forwarded.

CHAPTER TWO

LITERATURE REVIEW AND RELATED WORKS

2.1 Overview

Yet Ethiopia is still one of the most rural nations both in Africa and the world. Addis Ababa is among the fastest growing urban areas in the world. Since 1970, the population has increased by nearly three times. However, the spatial expansion of the urban area has been much greater. The earliest available *Google Earth* satellite photos (1973) indicate that the urban land area (continuous urban development) has expanded over 12 times. Thus, the urban spatial expansion has been at least four times that of the population over the early 1970s (Meheret, 1999). This rapid growth of the city highly demands parallel development of infrastructures. In side with the development and proper management of existing infrastructures is also important. Literatures related to Land and Infrastructures Management, Challenges and Problems encountered, Suitable Technologies and Applications and Information System Strategy Triangle were reviewed, then, the most related ones also selected and reviewed in more depth here under. Some were on land information management system, municipal asset management, infrastructure management and somehow integrating with GIS and internet.

2.2 Land and Infrastructure management

A research made by Nyongesa, (2012) in Kenya was aimed to develop GIS-based National Land Information Management System (NLIMS) to computerize the functions of the national land administration system and re-engineering the Ministry's business process that were paper based and has been in operation for more than a decade. NLIMS's main objective was to establish a quality land administration system that can facilitate efficient and effective service delivery. The project began in safeguarding and digitizing land paper records by setting up Land Records Conversion Center (LRCC) and equipped it well. Then LRCC developed an analogue and digital model for the land records. Then by using the 3-D enterprise Document Management System (DMS) software developed by Germany Company, configure and customize it. This software enabled the users in the ministry to access and share the stored files via Local Area Network facilitated the centralized retrieval of electronic archived land records. The project has also made

some capacity building activities like, establishing a modern ICT training laboratory and training the staffs.

Establishment of Geodetic Network, empowering field officers with ICT equipments, updating the local area network and acquiring support from partners for the development were the tasks performed to embark the NLIMS. The author listed some challenges faced during the process like the unfamiliarity of the technology, unavailability of the equipments, lack of experts mainly local and lack of complete and accurate records and information about the land parcels. However, the successful deployment and testing of the analogue and digital archived models, identification of too many miss-filled and missing records, improvement in retrieval and accessing of records, actualization of valuable records preservation and disposal of valueless records were mentioned as benefits of the project.

A research made by Ferreira and Duarte (2005) was mainly focused on the issues and needs emerged from previous studies by different authors involved in implementing Integrated Infrastructure management system in local municipalities. In the paper, they first introduced and discussed the functions of various participating divisions inside a municipal department of infrastructures. As stated in the research the Infrastructure departments of the Portuguese municipalities include more than 6 municipalities, the study was on, how to manage their infrastructures in number of systems by different divisions in the Department of Infrastructure.

Then, the researchers identified the issues and needs that must be fully understood and considered in the development of an Integrated Infrastructure Management System. Since the proposed solution is designing an Integrated Infrastructure Management System, two ways towards it are stated and analyzed. The first is to maintain the data in the current diverse format used and to develop tools and methods that support data warehousing, and access across multiple platforms and formats. Alternatively, one may redesign the entire data resource using a common format. The first alternative allows each organizational division to undertake the least change. The need of complex tools and methods, the management of the linkages and the formats was found to be problematic and moreover data might be spatially represented differently in each database. Therefore the actual spatial location of physical components cannot easily be determined and the data cannot effectively be used in combination with each other which allows

robust graphical and spatial display and analysis, or with a GIS. The second alternative provides an opportunity to design a common spatial framework that alleviates the majority of the problems noted above. However, this approach introduces organizational impacts and requires significant restructuring and rebuilding of existing databases. With the use of advanced information technologies such as GISs and database management systems (DBMSs) the integrated system will permit to combine efficiently tabular and spatial data that support queries, analysis, and report generation. This included involved determining and standardizing an effective base linear referencing system (LRS) to meet its needs, standardizing data terminology, determining the shared data needs of the several divisions inside the department of infrastructures, and developing a comprehensive database design with focused attention given to the types of data analysis functions performed by each division.

The paper includes the application of the IMS in road maintenance management and road safety management. The two sub-systems, a road maintenance management system and a road safety management system use the same base linear referencing system. In both subsystems, in order to handle dynamic segmentation, the road network model is composed by road segments with (x, y) coordinates and measure (m) values.

Finally the paper concluded that the proposed LRS will provide a common referencing platform in which different data types can be represented spatially in a network structure in a standardized manner and is a nucleus of the relational database and the GIS.

A paper by Jacobs, (2015) explored the type of technologies deployed in land administration to support the professionals on the sector in Sub Sahara Africa who are not mostly experts in the technology by offering them the theoretical framework that can help to understand the basic requirements of the technology. The author used a case study on Uganda and Ghana who have been working to modernize their Land Administration system for more than a decade on different phases and aspects of the system.

This paper in which the main objective was to analyze the impacts and trends of the technology, some literatures about the open source and proprietary software is made and revealed that the issue has been subject in both academic and industrial publications. The paper tried to view the real world scenario by comparing the case of Uganda’s and Ghana’s Land Administration

System projects deployed, one using open source software and the other off the shelf, DeSILISoR and GELIS projects respectively.

The paper provided the theoretical framework that Land Administration experts ought to practice to deliver the appropriate technology for LIS. The framework consists of attributes which against them the strength of LIS technology solution designs could be measured or tested, which are Scalability, Sustainability and Security.

Uganda's project consist three technological integrated elements, which were Geographic Information System (GIS), Document Management System (DMS) and Workflow Management System (WMS) and were integrated into one LIS. It was comprehensive, coherent and inclusive which minimizes the future risk of miscommunications between systems and subsystems, according to the paper. Though the project is not completed yet, some impressive feedbacks were produced, like a decrease in time to transfer property, reduction in time to process mortgage and a significant decrease in time to complete a search for encumbered titles.

Ghanaian's project was not similar to the Uganda's, but the main problems were listed for ease of reference, which are multiplicity of land tenure regimes, small legal land administrations with large informal ones administered in traditional authorities, outdated and poorly maintained manual land records. The project includes three stages which are LIS design and development of six subsystems, integration of subsystems into one system and data conversion (digitization) and upload to the system. Though the design stage recommended to use a free open source software for LIS development in 2004 (Byamugisha, 2014), a new study was conducted in 2009 and prepared details for implementation of Open Source Cadastral and Registry (OSCAR) tools (Hall, Quaye, and Mensah, 2009). The core software development and programming was to be done in Rome in first phase and customization in the second phase in Ghana, but yet the second phase was not carried out. However, Within the LAP but independent of the LIS, a Land Use Planning and Management Information System (LUPMIS) was designed and implemented. LUPMIS included the production of new ortho-photo maps integrated with existing spatial data to support land use planning at the national, regional, district, and local levels. In addition to LAP another project is implemented, which covered a relatively small pilot area, and the LIS

database management system was developed based on a proprietary software environment (Microsoft SQL Server).

Comparing the two projects, the author stated that, the Uganda's project was prepared based on preliminary design, comprehensive terms of reference and technical specification and implementation blueprint. Whereas, the Ghanaian project design and implementation activities focused on different elements and subsystems to be integrated latter. The 3Ss (Sustainability, Scalability and Security) attributes of the framework were used in the Uganda's project but Ghana's LIS was based on FLOSS, which resulted in a system that was neither sustainable nor scalable.

Finally, lessons learnt from this research were:

- LIS development and implementation should be considered as an integral part of Land Administration reform.
- Development of LIS is a spine of modernizing Land Administration System.
- Development of an LIS requires cooperation between agencies and among different levels of central and local governments. Land Administrators need to involve technical expertise before they decide on the technology
- System design requires careful consideration of the different technological approaches such as FLOSS or customer off-the-shelf software. FLOSS is not free. Experimentation can result in expensive lessons.
- Implementation of an LIS is best done in a sequence, starting with a pilot covering a limited area of the country, and eventually expanding to cover the entire country. It may take seven to ten years to fully implement, including the preliminary design stage.

Some essential issues were also pinned out:

- Development and implementation of LIS is a lengthy process and a long term activity.

To meet these requirements and to strengthen its feasibility, it is necessary to have a long-term strategy, realistic goals and objectives, and adequate management of stakeholders' expectations.

- Resistance is probable because LIS implementation requires a deep reengineering of many procedures and established practices, decentralization of decision making, and changes in organizational structures.

- Sustainability of project results through capacity development. LIS implementation requires development of new skills for personnel at different levels to enhance sustainability.

- Modernizing the LIS is not only about technology. The regulatory and legal framework needs to be modernized as well. A computerized LIS and electronic conveyance require a new legal framework in many countries. Similarly, a computerized LIS needs to be populated with a critical mass of spatial data, which will require accelerating land registration in most SSA countries.

The author concluded that technology is critical when deploying a Land Administration System, and if the technology is poorly selected the project will fail. And the vendor of the technology should demonstrate that the platform is sustainable, scalable and secured.

A paper was published on MDPI Sustainability journal by Lee et al. (2015) with a title "Suggestion for a Framework for a Sustainable Infrastructure Asset Management Manual in Korea". This paper proposed a framework for an infrastructure asset management manual containing infrastructure asset management processes and operation techniques, which can be adjusted by different ordering authorities to develop their own manuals. It first analyzed the changes and status asset management of domestic infrastructures, and inspected the status and what they called insufficiencies in the infrastructure asset management manuals of the government and authorities in charge by the time. Then they examined the status and system of infrastructure asset management manuals of foreign developed countries like Australia, Britain and United States of America to analyze and compare the characteristics of infrastructure asset management manuals in different nations. The study was limited its scope to infrastructures like

roads, railroads, harbors, dams, airports and other infrastructure assets (including waterworks) which are selected for the study by the government authorities that manages infrastructures.

Relevant materials and institutions were surveyed through publications and research papers by the researchers. Relevant authorities were also visited and interviewed to reflect their opinions on the current status of asset management and directivity for development, since the purpose of this study was to propose a framework for an infrastructure asset management manual to be utilized by ordering authorities. The scholar of this research tried to investigate the causes of infrastructure deterioration, like aging, improper use and management etc and maintenance costs. After going through the infrastructure asset management manuals of the mentioned developed nations, there needed to not only develop a manual for the infrastructure ordering authorities, but to provide a standard manual that considers mutual advancement of domestic and foreign infrastructure asset management companies. Based on the composition of domestic and overseas infrastructure asset management manuals, a framework for an infrastructure asset management manual that can be utilized by ordering authorities was proposed as

1. a general infrastructure asset management manual connected to global asset management manuals;
2. a manual that considers the experience of the ordering authorities in asset management;
3. a systematic manual that takes user convenience into account; and
4. a circulatory process, which links infrastructure policy and strategy with the decision-making stage.

A paper was produced by Too, (2008) that explored the practices of organizations that manage infrastructure assets to develop a framework of strategic infrastructure asset management processes. He stated that organizations owning and managing infrastructure assets are constantly striving to obtain the greatest life time value. This paper aims to first, review the goals of infrastructure asset management and investigate the extent to which they reflect a business resource approach to infrastructure asset management. Second, the paper will identify the core processes of infrastructure asset management. The research was a case study, thus the researcher used a qualitative methodology on data the data obtained from discussions with senior managers responsible for the management of infrastructure assets and analysis of documents obtained from

the organizations. He has also employed an interview organized around two research questions, which were:

(1) What are the goals of infrastructure asset management? and

(2)What are the core processes involved in achieving these goals?

The author, from his analysis, has formulated seven goals of Infrastructure management, namely Cost Efficiency, Compliance, Market Leadership, Quality: Reliability, Availability, Capacity Matching and Relationship & Communication. He claimed that these goals must support the organization business goals. According to this researcher, Organization can achieve sustained shareholder value by either productivity strategy or growth strategy. To achieve the growth strategy, businesses goals must aim at enhancing the opportunity to expand revenue and increase customer value. To achieve productivity strategy, the business goals should be to improve the cost structure and increase asset utilization. Hence, they need to develop the asset management goals that are aligned to these broad strategies in order to create value to the organization. He presented the symbiotic relationship between the Infrastructure Asset Management Goals and Business Goals, and then to achieve this balance, these goals should drive the core processes of infrastructure asset management as shown in the figure 2.1 below.

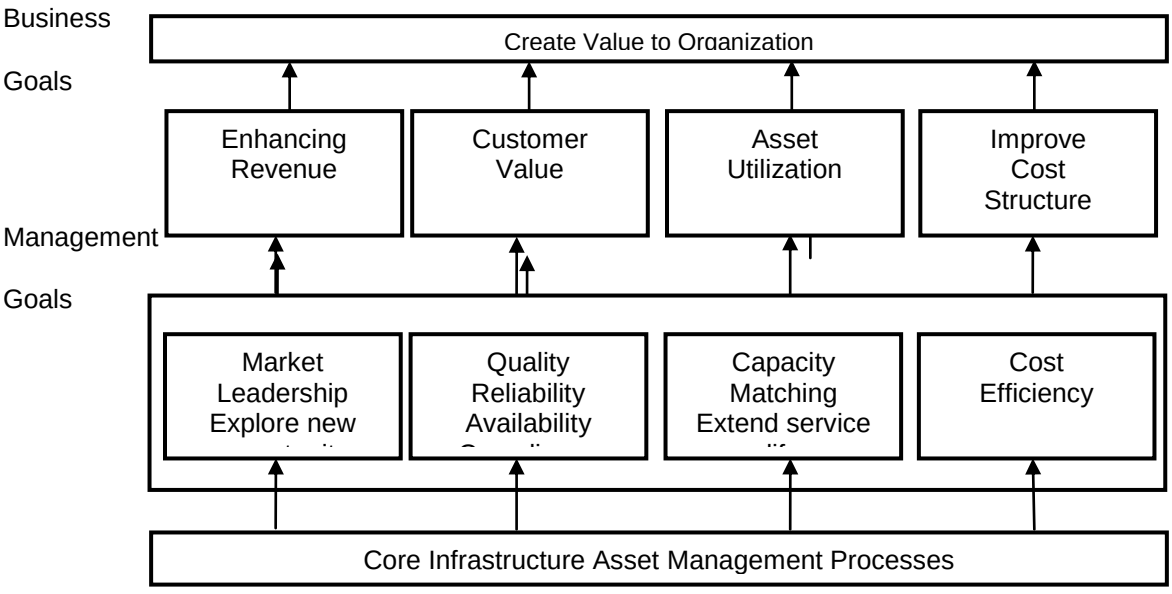

Figure 2.1: Symbiotic relationship between the Infrastructure Asset Management Goals and Business Goals and Core processes must support asset management goals

The infrastructure asset management processes should therefore convert the asset management goals into a sound business practice. The asset owners and its stakeholders can receive full value and return on their investment in infrastructure asset only through such goals driven approach to managing infrastructure assets. Asset management processes are in fact processes in which infrastructure asset is effectively managed throughout its entire lifecycle, incorporating acquisition, maintenance, operation and refurbishment. Based on the life cycle model approach, asset management processes are core processes within the three main clusters of sequential asset lifecycle phases namely asset planning, asset creation and asset operation and maintenance. Each of the phases consists of a number of supporting core processes. To achieve the goals of infrastructure asset management, the author has observed and six processes to be core from his study. He also presented the identified processes and their relationships in figure2.2 below.

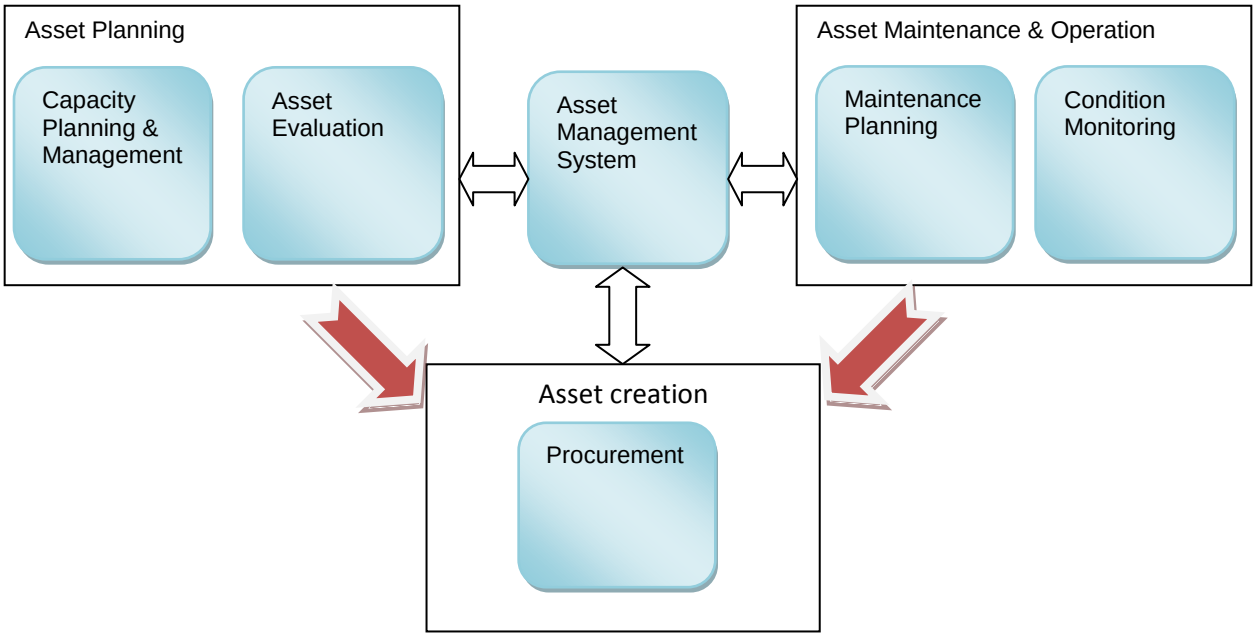

Figure 2.2: Strategic Infrastructure Asset Management Processes

After a thorough discussion on the processes, he emphasized on the central process which is Asset Management Process. Infrastructure owners and operators are constantly struggling with the lack of knowledge about the condition of the assets they possess. This means that the scarce resources that are available for maintenance and repair are often used inefficiently and appropriately. Information on current assets that are relevant includes physical (e.g. location and condition); financial (e.g. service potential, risks and liabilities); and performance (both service

performance and asset performance). This can be achieved by having a system that acquire and store the most updated and pertinent information on infrastructure assets known as the asset management system. Hence, asset management systems should be a centralized knowledge database that contains all the necessary information to support decision made at each and every core processes identified earlier. Synthesizing these processes, a SIAM is proposed as a strategic, fully integrated approach directed to gaining greatest lifetime utilization, effectiveness and value from infrastructure assets. At the heart of SIAM is a concept of continuous improvement to facilitate asset manager to identify, formulate and implement the most effective strategy and plans for improvement.

2.3 Suitable Technologies and Application for Land and Infrastructure Management

Mao (2005) conducted a research in order to explore the impact that the new and emerging technologies (particularly GIS and Internet technologies) have for resource management in Canada. The research came up with a web-based GIS prototype that can support the resource development and management process on Aboriginal communities in Canada.

The author stated that the data and information on Aboriginal communities' land and their activities are placed separately in different agencies, government and non-government organizations. The information on the websites of the government organizations and the communities' network are in HTML format, which is incompatible and time taking for end users to use this information for further studies on how to use and develop the land in question. There is no centrally maintained website that provides integrated information1 retrieval services. The four problems he stated are: first the information are mostly incomplete, second they are not geo-referenced, third the static maps are not suitable to satisfy the need of end users, and fourth the descriptive information are not linked to the spatial location of the land intended. Therefore the commercial developers can't get complete information about the land that interests them just by looking the maps or any other descriptive documents. And also the planners and land managers are also the victims of such a problem. In order to overcome these problems the researcher believed that there needs an integrated way of disseminating the information needed for decision making, data collection, data integration and analysis.

As a tool to integrate, manage, and visualize spatial data, Geographic Information Systems (GIS) have been accepted as a useful solution for resource mapping (Bernhardsen, 1999).He noted that Internet Map Server (IMS), such as ESRI ArcIMS and Intergraph Geomedia Webmap, is usually installed in most web GIS implementations and to easily provide the very basic functions like browsing, searching and accessing of spatial data, some interactive queries and spatial analysis tools (such as buffer and overlay) are also needed to be developed. For such application of this research He also included textual (both tabulated and not tabulated) or descriptive information on the website. The research had three phases, which are analysis and problem definition, prototype system design and implementation, prototype system enhancements and advanced query implementation.

In the first phase, the first thing he did was literature review on related cases, which were the Aboriginal rights in resource management in Canada. Then some more literatures on Web GIS applications in resource mapping and land use planning were reviewed. As a result he restated that Internet Map Server is the vital part of Web GIS and compared the two available commercial software packages, ESRI's ArcIMS and Intergraph's Geomedia Webmap. In order to evaluate and select the appropriate IMS, he needed to study their system architecture and how they work in depth. Then he selected one of the three northern territories of Canada, Yukon, where 24% of the population is first nation peoples, to use as a research site.

The second phase was data collection from different sources, like government organization's websites, multiple national databases. Some more data have been collected from local websites, books and videos related to Aboriginal territories, natural resources, land use activities and legislation. Then, spatial and attribute data, and other legal information were processed, spatial database was designed. Here also further literature review on Web GIS was conducted, specifically on their system architecture, and prototype system architecture was designed. Before the development of the system, different software for the development of web server and map server were installed and developed.

In the third phase, the prototype was developed by customizing the Internet Map Server (IMS) using ArcXML programming. Web based spatial data analysis tools, like buffer and overlays, are

also examined to the implementation for the prototype. Finally security issues were also addressed.

The output of this research was a Web GIS prototype which helps First Nation communities, land managers, land developers and various academic and governmental agencies. The prototype has spatial data and legal information that are highly connected to the land and resource management of the First nation peoples. It is an integrated on-line system that can provide sufficient information for the mentioned end users to support a better decision making. It also benefits the self-governing Aboriginal communities throughout Canada by providing adequate legal and spatial information of their land whenever they need to browse, query and analyze. As the matter of fact, this system was intended to the Aboriginal citizens, but it can also be useful to any other interested bodies to use Web GIS system for their possible needs. The system has been customized by using Map hyperlinks and other supporting tools so that it can provide better information, compute advanced queries and also to be an efficient way of information retrieval process.

An Internet GIS application is developed and an integration of GIS information technologies was proposed by Deeprasertkul and Chitradon (2009). This author described the Internet GIS application architecture and general features to provide a framework of water resource management. The application was developed by using PHP, HTML, and Javascript computer programming languages. The internet GIS technologies integration was implemented by using a combination of MapServer base map and Scalable Vector Graphic or SVG base map. The user interface incorporated two main features which are MIS and GIS, where MIS is used for a representation of non-geographical information and the other to handle the geospatial information. A program interface between modules and GIS operation tools were programmed in JavaScript and the user interface was developed by PHP, HTML and XML programming languages. The author concluded that cooperation between MIS and GIS could be advantageous for an Internet GIS application because it definitely helps the governments to make better decisions.

2.4 Challenges Related to Land and Infrastructure Management

Most of the countries, specially developing countries have different challenges and problems either in land management or infrastructure provision and management. For instance, a volume produced by The International Bank for Reconstruction and Development / The World Bank (2005) aimed to meet the infrastructure challenges in Philippine reported that infrastructure deployment has not kept up with high population growth and rapid urbanization, with serious consequences for the country's competitiveness and in particular for its growth and poverty reduction targets, including the Millennium Development Goals. The report said "The key challenge for the Philippines is to implement the agreed frameworks rapidly and consistently.

The report suggests that the way forward for sustained development in infrastructure requires instigating a rigorous fiscal reform program; pursuing continued reforms in key sectors—particularly power, roads, and water—to improve cost recovery, competition, and institutional credibility, and to sharply reduce corruption; improving central oversight of the planning and coordination of investments; and making a few focused investments through public-private partnership to address key bottlenecks and achieve quick gains in service delivery. The major challenges stated were: Deteriorating quality of infrastructure, low current spending on infrastructure, inefficient use of existing resources, poor business environment, unsatisfactory public sector performance, corruption, decrease in private sector involvement, low credibility of institutions, lack of insulation from short-term political pressures, lack of regulatory coordination, limited regulatory capacity, judicial intervention in infrastructure decisions and some others. To tackle these challenges, minimizing corruption, maximizing competition, increasing institutional credibility, improving policy planning and coordination and enhancing financial mobilization were suggested actions.

One of the research report found was conducted on Major land development challenges of Addis Ababa city from the perspective of general land development procedures of the country. Land development as Enemark (2009) said is one of the four functions land management has to deal with, the other functions were land tenure, land value and land use. Abebaw (2017) defined land development as the processes of implementing land-use planning or development proposals for building new urban neighborhoods and new physical infrastructure and managing the change of

existing urban or rural land use through granting of planning permissions and land-use permits. Hence, land development is an issue of land management and provision of infrastructures including other activities.

The author of this paper begins by introducing that land is the major economic factor and its being of crucial for the development of a country. Then he defined land administration as a process of implementing land related policies and land management strategies to ensure economic, social equity, and environmental protection issues. The objective of the research is to assess the land development procedures, to show the challenges and recommend a solution. It listed out the procedures in land development referring to the proclamation and implementation rules related to land development in the city. Within each procedure, the author tried to assess the challenges and presented a discussion about them. The procedures mentioned there are planning, site identification, site delineation, land acquisition, infrastructure provision and also some more detailed procedures in the process of land development. The rest of the procedures raised here are a bit far from the main focus of our research, which are technical activities performed in the authorized bureaus, like land parcelation and surveying works, submission and application of plans, building permit and other procedures related to these. The paper discussed on each procedure in detail with challenges resides there. The major challenge discovered is the impracticability of the proclamation and its implementing regulation, mentioned as proclamation number 624/2009 and its implementing regulation number 243/2011.

The main reasons or problems associated with the impracticability of those procedures are the law institutional and personal capacity, attitude of experts and officials towards corruption and rent seeking, and others. As a solution the author proposed the following activities to be held by the responsible bodies. Government should give high emphasis on the capacity building for experts as well as higher officials. Institutional arrangement should also be a crucial point so as to come up with the capacity and the other problems mentioned above. The attitude of experts and officials towards corruption and rent seeking should be reduced, if possible avoided, by working on the mentality of individuals. To do so awareness creation works should be one responsibility of the government. The government should enforce the laws on corruption and rent seeking seriously and corruption and rent seeking which are found on the area should be

penalized depending on the mouth of the law, which is crucial to deter the criminal specifically and the public at large.

On another paper by Oyedele (2012) found out some challenges of infrastructure development with respect to democratic governance. The objective of his research was only to explore and articulate the challenges Nigeria's government encountered on infrastructure provision and development but not suggesting a solution. The challenges this author stated in his research were dearth of visionary leaders, demand and supply, PESTLES Analysis (which is a concept of economics), PARETO Analysis (a statistical tool, also called 20/80), project management, procurement method and corruption.

The focus of this research is to explore the challenges and problems, which were not examined by other researchers or seen in different perspectives. Thus the main challenges identified by the scholars so far are: deteriorating quality of infrastructures, low investment, inefficient use of existing resources, poor business environment, unsatisfactory public sector performance, decrease in private sector involvement, low credibility of coordination, limited regulatory capacity, judicial intervention in infrastructure decisions, dearth of visionary leaders, demand and supply, PESTLES analysis, PARETO analysis, project management capability, procurement methods, corruption, sustainability of buildings and infrastructures, urban planning and integration, informal settlements, environmental management and investment in human capital. The challenges and problems related to the crossing over amongst infrastructures haven't been studied yet. Therefore these challenges and problems were explored and empirically investigated in this research.

2.5 Information System Strategy

Because of the wide possibilities opened up by today's IT capabilities, IS functionalities and information use, business organizations are given every chance to determine what and how they wish to accomplish through IT. Organizations need to choose the appropriate IS and IT strategies to justify their IT investments and, at the same time, increase their performance, effectiveness and competitive advantages.

There is a simple framework for understanding the impact of IS on organizations known as Information Systems Strategy Triangle (see Fig. 3) which relates business strategy with IS strategy and organizational strategy (Pearlson and Saunders, 2009). This framework is widely used in researches conducted in Information System Strategy development.

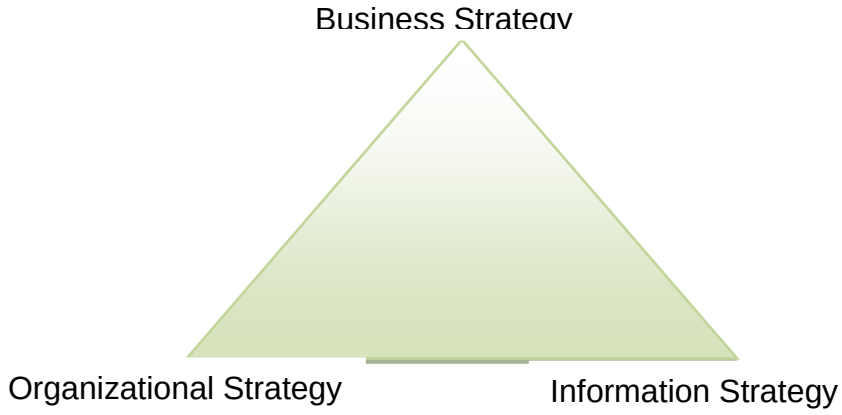

Figure 2.3: Information Systems Strategy Triangle framework, (Pearlson, K. & Saunders, C. (2010))

One of the researches was by Oktavia (2014), which was made on The Correlation between Business Strategy and Information System Strategies which focused on Education Institution and its concept and Design. It was an empirical research and data were collected using questionnaire to members of education institution, with relevant parties that involved (Academic and IT Staff, lecturers, and students). Then to identify the right option and a business process that must be linkage in organizational with a substantial part of sophistication in information management he mapped the questioner result into IS/IT strategic model.

The author stated that Information Systems (IS) nowadays are integrated with almost every functional of business line because it can accommodate to simplify company activities and increasing effective and efficiency process, as part of Information Technology. He emphasized that Information System Strategy must be aligned with the organizations perspective towards business model and if an IS failed to support its organizational process the impact is misalignment of the resources needed to achieve its goals. The success depends on how the company stimulates business strategy to drive both organizational strategy and IS strategy. IS strategy itself is affected by developing a procedure in a business and organizational strategies. Referring to the Information System Strategy Triangle, he stated that IS strategy and organizational strategy must constantly be adjusted in parallel process. When defining Business

strategy, he said it needs to include vision, mission, objective, purpose, and goal while Organizational strategy includes people, work process environment, organizational structure, and planning to achieve business goals.

Then, Information Systems Strategy is the plan to implement information services in accordance with business process. Those strategies must be collaborated to establish enterprise wide architecture that can support business functional. He also defined strategy is a set of coordinated actions to achieve anything they need to be implemented, such as objectives, purpose, and goal. The researcher tried to differentiate IT Strategy and IS Strategy. On due his explanation, IT strategy is concerned with outlining the vision of how the organization's demand for information and systems will be supported by technology, while IS strategy defines the organization's requirement or demand for information and system to support the overall strategy of the business functional. He claimed that formulation of strategy for effective utilization of IS/IT is not simple, since Strategy drives architecture, which drives infrastructure as well. According to Oktavia (2014), model of strategic planning for information systems and information technology in his study is divided into seven.

1. Internal business environment consists of different activities which are subcategorized in to Major activities like, Admission system, Academic activities, Collaboration and partnership, Lecture resources management, Community services; and Supporting activities like, Financial management, Information technology, Procurement, Human resource management.
2. External business environment which includes factors like economic conditions, industrial environment, government policy, competition among institution and partnership in education institution.
3. Internal IS/IT environment the configuration for IS/IT architecture from many perspective in the business, maturity, scope of business, contribution, skills, resources, and technological infrastructure.
4. External IS/IT environment consists of technology trends and opportunities and the function of information system and information technology to others, especially student as customer, lecture, competitors, and suppliers.

5. Business strategy: This aspect describes about how IS/IT to support business objectives and application portfolio for the business unit and business models in education institutions. Management control systems must respond to the objective of organizations. And in this activity, three important roles IS have in management control have been described, as Data collection, Evaluation and Communication.
6. IS/IT Management strategy: This element of the strategy to ensure a consistent policy to apply IS/IT. According to the analysis in several education institutions, management strategies were simulated as follows:
    a. Corporate contribution
    b. User orientation
    c. Operational excellence
    d. Future orientation
    e. Knowledge and experience is the
7. Information Technology strategy is the last one and it consists of policies and strategies in the management of technology and specialist resources. For an example create of a user right, procedure to operate the system, standard operation, system documentation, etc.

Finally as an output of the research the researcher converted the accumulated criteria of business IS demand into recommendations for the development of IS/IT planning for both short term and long term.

Short term planning recommendations were:

- Increasing service of quality and best practice for any area of core business process.
- Development of human resources (staff, lecture, etc) both technical skill and soft skill and how they can adapt with the new system.
- Documentation for all application system It needs to keep documentation of application that developed in institution because it possible to enhance the application in the future need.
- Training for user
- Research and Development Business Process.
- Reward and Benefit System

- Utilization of social media and forum that allows member to create public account with their interests, and

Medium and Long term planning recommendations were:

- Cloud computing
- Mobile Computing
- Cooperation in research with external companies
- Development Adaptive Platform, and
- Apply to Certification ISO

Teubner et al. (2010), had three goals: to provide a conceptual definition from organizational perspective, to deliver a new typology for the operations of IS strategy and measurement tool, and to provide implications of their proposed IS strategy typology to the three streams of literatures they have reviewed during their research. Through their systematic literature search on articles published in leading IS journals that focus on the construct of IS strategy, they identified three conceptions of IS strategy employed implicitly and they were:

1. IS strategy as the use of IS to support business strategy;
2. IS strategy as the master plan of the IS function; and
3. IS strategy as the shared view of the IS role within the organization.

The third conception, which is highly relevant to our research, revealed by the authors described IS strategy as a shared view regarding the role that IS plays within the organization. In this context, IS strategy is viewed as an organizational perspective that guides future IS-related business decisions and activities rather than of a concrete plan or a position as in the previous two conceptions. This third conception of IS strategy represents a higher order concept than the first two. Specifically, this conception not only covers Earl's (1989), three sub-domains (i.e., what, how, and who) of the management strategy of information systems, but it also suggests that IS related decisions are contingent on the chosen role of IS agreed upon by the top management. Therefore, this conception of IS strategy is organization-centric, which bridges the two extremes of business strategy-driven logic and IS function-driven logic in the two prior conceptions. An organizational perspective ensures that all members of the organization are

heading in the same direction and consequently leads to building some consensus regarding the role of IS vis-à-vis the rest of the firm and the resources that will be committed to achieving that role. In this conception, the IS strategy is not necessarily dependent on a particular business strategy. A limitation of this conception of IS strategy is, it generally reflects a top-down perspective (i.e., the business and IS executives' views) of IS strategy within an organization. However, some organizations might practice a bottom- up perspective to develop their strategy. In addition, the nature of IS strategic alignment could differ across organizations that have different IS strategies. An organization's type of IS strategy, which is contingent upon the external environment, will have different levels of influence on organizational outcomes such as competitive advantage and firm performance.

The first goal of this study was to provide a definition of IS strategy designed to promote future research examining the organizational IS strategy development process. In doing so they suggest that, conceptually, IS strategy needs to be examined independently of the examination of business strategy mentioning Agarwa and Sambamuthy's (2002), argument which sais IS strategy can both support and lead business strategy. They have described various definitions of strategy in the extant strategic management literature and justified the definition of IS strategy employed. Then, they drew their definition of IS strategy as "an organizational perspective on the investment in, deployment, use, and management of information systems" from the findings in the strategic management literature by clarifying the general definition of strategy of Mintzberg (1987) as an organizational perspective on setting and meeting organizational goals. Furthermore, they argued that though their definition of IS strategy suggested that IS strategy is part of a corporate strategy, conceptually it should not be examined as part of a business strategy. Rather, it is a separate perspective from the business strategy that addresses the scope of the entire organization (i.e., IS investment, deployment, and management) to improve firm performance. Based on this definition, they reviewed and examined the various ways in which IS strategy has been conceptualized in prior literature.

The second goal of this study was to deliver a new operational typology for IS strategy in a way that can be applied in a holistic sense to the organization. They also reviewed and examined different literatures of SISP, competitive use of IS and other literatures examined various organizational IS capabilities rather than a specific IS strategy. Some IS alignment literatures

attempted to develop measurement for IS strategy and were found to treat IS strategy as a realized rather than intended strategy that is designed to be dependent on and match with certain business strategy, and some others found to equate existing IS application portfolio with IS strategy. Eventually to resolve the limitations found by then, they attempted to develop a validated measure of IS strategy by using survey data collected from 174 matched pairs of chief information officers (CIOs). Thus, organization's IS strategy has fallen into one of the two defined categories, which are IS innovator or IS conservative or simply undefined. Finally they offered a diagnostic tool which they claimed it to be useful for both IS academics and practitioners to assess different organizational IS strategies.

The third goal of the study was to provide implications of their proposed IS strategy typology to the aforementioned three closely related streams of literature around IS strategy (i.e., SISP, IS alignment, and IS for competitive advantage). In addition, they developed formal propositions that relate their conception of IS strategy to each stream of research. Specifically, they argued that organizations with different IS strategies will vary in their strategic IS planning practices.

For implications on the literatures of SISP they developed propositions:

Proposition a: For IS innovators, the use of a less formalized approach will be positively associated with IS strategic planning success.

Proposition b: For IS conservatives, the use of a more formalized approach will be positively associated with IS strategic planning success.

Proposition c: For IS innovators, the use of a bottom-up approach will be positively associated with IS strategic planning success.

Proposition d: For IS conservatives, the use of a top-down approach will be positively associated with IS strategic planning success.

For implications on IS alignment:

Proposition a: For IS innovators, IS strategy is well positioned to drive business strategy.

Proposition b: For IS conservatives, business strategy is well positioned to drive IS strategy.

And for implications on the competitive advantage related literatures:

Proposition a: IS innovators will have a greater level of association with firm-level competitive advantage than IS conservatives

Proposition b: IS innovators will be associated with higher levels of firm-level performance variation than IS conservatives.

The paper concluded by stating that by understanding that the focal point of alignment is a shared view (among the organization's top decision makers) of the role of IS within the organization, executives are empowered to develop this collective viewpoint. In addition, this study provided guidelines for business executives to examine the strategic planning process, the dynamic interplay between IS strategy and business strategy, and the impacts derived from IS strategy.

Today, because information systems serve as the driver of many organizational transformations, there is increased pressure on organizations to leverage their investments in technology and information systems. The strategic information systems planning process is intended to ensure that technology activities are properly aligned with the evolving needs and strategies of the organization. Pollack, (2010) has examined the research on this ever-important topic and has suggested a process that would assist in the achievement of planning success. A framework that helps to clarify the importance of information systems in today's organizations is the Information Systems Strategy Triangle. The triangle has conveyed a message that it is important for the three elements of the triangle, namely Business, Organizational and Information Systems strategies to align with and complement each other. The author of this paper defined the three elements referring Pearlson and Saunders, (2010) as follows.

- Business strategy starts with a mission and is a coordinated set of actions to fulfill objectives, purpose and goals and serves to set limits on what business will seek to accomplish.
- Organizational strategy deals with the people, work processes, structure, hiring practices and plan that allows for achievement of business goals (p. 380).

- Information systems strategy is the plan an organization uses in providing information services.
- The direct or implied suggestions about strategy that are derived from the framework includes: "Successful firms have an overriding business strategy that drives both organizational and information systems strategy."
- "IS strategy can, itself, affect and is affected by changes in a firm's business and organizational strategies. Changes in the IS strategy must be accompanied by changes in the organizational strategy and must accommodate the overall business strategy."
- "IS strategy always involves consequences, intended or not, within business and organizational strategies."

Regarding the process planning the author stated that it can become a lengthy and rigorous ordeal. While analyzing the process, he said that some feel it unfolds in five phases. These phases are:

1. Strategic Business Planning – Prerequisite to systems planning and consists of mission, future direction, targets and strategy.
2. Information Systems Assessment – Evaluation of current IS resources and how well they are serving the organization.
3. Information Systems Vision – Ideal role that should be pursued for use of IS resources.
4. Information Systems Guidelines – Set of statements that articulate use of organization's technical and IS resources.
5. Strategic Initiatives – Three to five year long-term proposals that stipulate new initiatives for IS organization

Strategic information systems planning was previously the work of technology and systems professionals. It has now changed to be a collaborative planning challenge of parties including top managers, business unit managers, technology and systems professionals, and sometimes external stakeholders such as customers and alliance partners. The paper mentioned about eight popular techniques and how different organizations adopt and combined different techniques in their planning processes. However, the intended result of the planning process is to arrive at an IS strategy. The author stated that contend that the IS strategy has four distinct components: the

Information Strategy, the Information Technology Strategy, the Information Management Strategy and the Change Management and Implementation Strategy. The Information Strategy answers the questions: what information is required and where is the information required to support the primary tasks, or key goals? The Information Technology Strategy is concerned with applications and platforms to provide the information. The Information Management Strategy is concerned with how the information services are organized for the different facets of the organization. The Change Management and Implementation Strategy will identify what organizational change will be needed for the information systems strategy to be successful, when it will be implemented and by whom. The outcome document from this planning process should be a comprehensive report along with plans for the development of systems oriented to some future vision of the role of information systems within the organization.

From the perspective of Technology-Based Approach to Planning he said the online approach is particularly attractive. To justify this he said "In recent years, online electronic tools have emerged to assist with the planning process". And also he added that participants can connect to a host website from their own facility and enjoy the same benefits as face-to-face sessions. The key to success, Opened-ended questions and ranking of elements on matters such as organizational mission, values, current state of the organization, external environment, overall organizational alignment and future direction must be addressed. Beside this the quality of the front-end preparation and the quality of the skilled facilitators plays the vital role.

In his conclusion the author stated that technology and information systems play an ever-increasing role in today's organizational environment. Because of the rapidly changing nature of technology developments, it is sometimes difficult to employ standard planning processes. The primary guideline for information systems planning is that the planning process must be designed and conducted in alignment with organizational and business plans. Most organizations now agree that IS is an important strategic organizational resource that can provide strategic advantage and boost performance. Finally he declared that there are multiple planning tools available for the strategic information systems planning process. Choosing the tools that meet the needs of the organization and lend focus to the desired areas of emphasis is critical. Thus organizations should consider the introduction of technology-driven approaches to planning to help with speed, efficiency, flexibility and communications.

2.6 Related Works

Infrastructure Information Management System of the Dakar Metropolitan Area in the Republic of Senegal

The incapability of the city for accommodating its highly dense population with a developed infrastructure resulted in serious problems like, random urban sprawl and deterioration of environment and infrastructures. Efforts by the responsible department of local governments couldn't achieve their primary purpose and its inefficiency is pointed out, such as duplicate efforts for information development and incompatibility of information among different departments. Therefore, it was desired to establish an information management system for urban infrastructure using GIS in order to support the development of urban facilities and services in the Dakar Metropolitan Area. This resulted into a development of Infrastructure Information Management System (IIMS), so that data can be shared and compatible among responsible departments. The mission to establish this IIMS has included international agencies like Japan International Cooperation Agency (JICA) and other local organizations like Department of Urban Planning and Architecture (DUA) of the Senegal's Ministry of Urban Planning and Housing. The overall project processes has been summarized as follows.

Infrastructure Information Management System and a role of GIS

The first thing they have done is collecting descriptions of urban issues in the Dakar Metropolitan City, that is called urban carte, in order to conduct evaluation and analysis of phenomenon in urban planning and consider the potentiality of GIS application as a solution of urban issues. As a result of consideration, it was designed including both of a database and a system, which structured information management system, associated with infrastructure, and then the system and a constitution of its management and maintenance. The Urban Carte was deliberately made to describe the specification of urban issues, cause analysis, action programs and responsible departments, the necessity of data related to action planning, and the possibility of GIS applications. Its target was transportation, flood, water and sewer supply, sewage disposal, garbage disposal, residential land, the lack of multifamily housing and public space, low-quality housing, insufficient services for emergency, and poor public facility. A support

system to resolve urban issues by utilizing GIS was developed through designing database necessary for this application.

Datasets of infrastructure information was created by updating existing topographic maps in the Dakar Metropolitan Area. This database is composed of geospatial database and other types of GIS data. Since the data among individual organizations were not compatible and difficult to import/export data straightforwardly, inventory was made of related departments in order to identify the availability of existing data. According to the inventory's results, it became clear that management and maintenance is a key subject for the establishment of database. The mission reconstructed new datasets, which is used 1:5,000 topographic map as a base map for geospatial database, which updated existing topographic maps by utilizing aerial photos, and attribute data collected in the field on top of a base map.

In addition to the construction of the new dataset, the mission has also established a system of Infrastructure Information Management Planning that constitutes several sub-systems, which are: Urban Information Reference, Urban Development Management, Urban Planning Support and Residentially Suitable Land Evaluation sub-systems.

A sub-system for urban information reference

It is established a sub-system that an application can query, display, compile, and prepare a thematic map for a purpose of information inquiry concerning urban planning. Thematic maps prepared for the system include information in public facilities, public services (garbage disposal and public transportation), infrastructure (roads, railroads, water supply, sewerage, and electricity), population, change of urbanized districts, the condition of land-use planning and zoning, and current land-use distribution.

A sub- system for urban development management

In order to standardize the management both of plans and appropriate criteria related to applications for construction permission, information filled out the application is putting into a database. The record management system was established to search and display information they need from the database.

A sub-system for urban planning support

This system was established as an application considered the best location of public facilities by utilizing several layers of administrative boundary, census data, and distribution of existing public facilities and present land-use.

A sub-system for residentially suitable land evaluation

A sub-system for residentially suitable land evaluation was established as an application, which supports evaluation of residential environment and selection of a new residential district by means of geospatial database and GIS data, according to a current housing development plan.

The purpose to establish the system is to utilize the system more practically among associated organizations. Thus, there were enhanced efforts of holding seminars, workshops, and trainings in the field to transfer technology. The Department of Geographic Survey and the Department of Urban Planning installed both hardware and software for the management system. Trainings were given for responsible officers in both departments, such as setting up and operating hardware, installing software, establishing the Infrastructure Information Management System by creating a database, operating the system and holding practical trainings how to operate GIS.

As a conclusion, the report by Suwabe (2012), stated that it is essential for Infrastructure Information Management System to update database, develop the system and human resource, and maintain facilities and an important task in the future to accomplish these assignments continually. It is necessary for an establishment of geospatial database in the country to enhance the consensus among different organizations for sharing data and practice the collaboration in future projects. In addition, the sustainable development of the system is dispensable to continue technology transfer and develop human resource constantly.

Establishment of Geographic Information System for DKI Jakarta in the Republic of Indonesia

The objective of establishing a geographic information system (GIS) for the efficient and effective support of land administration within the local government of DKI Jakarta. The work on the project has evolved through Phase I and II, performed by Pasco International Consortium

under the finance of OECF, Japan. The DKI Jakarta GIS Project was objected to develop an operational GIS, having eight applications for four “core” applications and four “Remaining Priority Applications. The GIS was developed for use at the Sub-Directorate level of local government and the Division level within the five Regions that comprise DKI Jakarta. The participating Sub-Directorates and Divisions were:

DPPT, Surveying and Mapping Department

DTK, City Planning Department

DPPK, Building Development Control Office

BPN, National Land Board

BAPPEDA, Regional Development Planning Board

KPDE, Electronic Data Processing Office

The objective of Phase I was to create the conceptual system design and a detailed physical design for GIS application and database. Phase I was followed by the preparation of a technical proposal for extending development of the GIS into a Phase Ⅱ. The objective of Phase Ⅱ was to implement the GIS according to the system design during Phase I. The Phase II was comprised of sixteen tasks, i.e. six consultant tasks and ten contractor tasks:

Consultant Tasks were Project Management, Program Planning, Database Development Pilot Study, Application Development and Testing, Institution Building and Training Program.

Contractor Tasks were, Aerial Photography, Field Survey, Base Map-Plotting, Data Collection & Compilation, Structure Map Digitizing, GIS Layer Digitizing, Site Preparation of GIS Office, Networking, Hardware Installation and Software Installation.

The 8 applications were split into two groups. One group was called the “core” applications and consists of the following:

1. DTK Site Measurement Application

2. DTK KRK8 Planning Advice Application

3. DTK Planning Related Records Maintenance System

4. DPPT Library Maintenance System

The other 4 were placed in a group called the "Remaining Priority Applications" and consist of the following:

1. The Map Creation System

2. DPPK Building Footprint Update Module to Support IMB9 Permit System

3. DPPK Building Footprint Update Module to Support IPB10

4. BPN Parcel Maintenance System

Benefits of DKI Jakarta GIS

DKI Jakarta realized many benefits from implementing GIS technology. These benefits arose from the coordination of data activities among the agencies and from the efficiencies brought by computerization. GIS brings special benefits because it combines maps with tabular data. This makes the computer-generated maps a very rapid method for viewing and analyzing a variety of information (Hayakawa, 2012).

- Accurate geographical data supports urban development policy making, strategic planning and daily operations. Precise and properly controlled geographical information is critical as a basis for policy and supporting strategic planning and daily operations for urban development in Jakarta. The GIS brings together many types of map data based on the same coordinate system. This will speed up the development review and approval process for agencies.
- Accurate geographical data improve identification of taxable objects and improve capacities to increase tax revenues. Such information is also essential for identification, registration, valuation, and assessment of taxable objects. As such, these geographical

data will be at the foundation of implementing laws targeted as increasing tax revenue from land, buildings, and other tax objects.

- GIS encourages agency coordination and data standardization GIS is a data integration tool. For agency to make the best use of its capabilities, they will need to access the data of other agencies. For data access and sharing to be successful, agreement must be reached on data standards. The opportunities for this were particularly strong among the land registration, land planning, and building processing, taxation, and mapping agencies.
- GIS will enable graphic (map) and non graphic (tabular) data to be used together to support a variety of analysis, mapping, and reporting functions. The GIS makes maps and analysis and display tools for all tabular data related to geographic locations such as buildings, parcels, roads, and utilities. These functions cannot be performed manually. This will enable immediate viewing of issues, such as delinquent taxes, and opportunities, such as coordination of development activities, that improves operations of DKI Jakarta agencies.

GIS Applications for Urban Facilities Management

Another paper by Nishimura (2012) has reported the "Establishment of Database for Geographic Information Systems of the Capital Area of the Republic of Madagascar", which produced three types of geographic information database for urban base maps, land-use/land-condition maps, and urban facilities were built. This report is about the development of the urban facility database and introduced the background for the development and database production. First, the target facilities (road, sewerage, water supply, electricity, and communications facilities) were selected. Then, the items and structure of the database were determined on the basis of the results of a hearing survey undertaken for the required GIS functionality at the related organization. Finally, the information necessary for urban facility management was entered into the database.

Selection of Target Facilities

For the selection of target facilities, a guideline for development of the urban facilities database was established. The guideline was:

1. To acquire the data allow a better understanding of the existing conditions of the urban facilities in the city and surrounding areas.
2. To develop the database that can be used effectively for city plans and urban facilities construction plans, as well as for the management and maintenance of urban facilities.
3. To develop the database with an architecture that allows the simple and fast building and updating of data.

Following these guidelines, a survey of the database functionality was made with the related agencies, and the urban facilities and related agencies to meet the said guidelines were selected for the database to be built. The agencies were those responsible in development and management of the infrastructures, like Roads, Water Supply, Sewerage, Electricity and Communications.

Study with the Related Agencies

After the selection, a hearing survey with the agencies related to urban facilities was made for items like:

- Procedures of urban facilities maintenance and management works,
- Materials (data) used for urban facilities maintenance and management works,
- Issues and problems in urban facilities maintenance and management works,
- Relationship with other agencies related to urban facilities and
- Effective use of materials (data) following the establishment of the database

The survey on Items showed that:

- The drawings of the facilities had often been used in the maintenance and management works, and that the retrieval of those drawings took considerable time.
- It was important to efficiently update the drawings for maintenance and management of urban facilities, and that there were problems of lost drawings and method of taking custody of the drawings.
- The related agencies prepared individually the drawings for maintenance and management.

- If the database of the materials for maintenance and management of urban facilities is produced, then the works of maintenance and management would improve substantially.

Data Acquisition for Facilities Management

During data acquisition, two types of materials for the maintenance and management of urban facilities were collected. These data were Drawing materials that includes Topographic maps and facility completion drawings, and Statistic materials like Forms and registers.

Classification and Analysis of Collected Materials

Then, the materials that were collected from the agencies related to urban facilities were classified in four categories.

1. Graphic materials from which the geographic locations can be specified: Piping and cabling drawings
2. Graphic materials from which the geographic locations can't be specified: Structural drawings
3. Text materials related to the graphic materials: Contracts and agreements
4. Text materials unrelated to the graphic materials: Various forms

These categorized materials were analyzed and it is found to be that:

- Dates of the materials, which were defined for almost all materials.
- The locations of most facilities could also be defined on the city base map database.
- The materials categorized in second and third had a low frequency of utilization in the maintenance and management works.
- Some of the materials in the fourth category were available following the production of the database.

Requirements for Facilities Management and Examination of GIS Functions

Requirements for Facilities Management

Based on the analysis result, the requirements for Facilities Management were formulated and the functionalities of GIS were examined. The requirements of the IMS were:

- The rational methods of custody of materials for facilities maintenance and management and retrieving the necessary materials, whenever needed
- The function for a fast retrieval of necessary materials for the facilities maintenance and management by designating the scope and number of copies.
- The functions for a statistic process (such as addition, subtraction, multiplication, or division) of the numerical information in the materials for facilities maintenance and management and for obtaining immediate results.
- The function of mutual correlation of the materials in a simple manner, since a large number of materials relate among them.

GIS Functionality

Based on the discussions on the requirements as described above, it is found that the following functions could be run on the GIS software (ArcView):

- Graphics-based functions: Scroll, zoom and scaling of graphics, display of specific items, and color designation.
- Retrieval functions: Retrieval through key codes, locations, and other conditions
- Statistic functions: Data sum-up
- Display (output) functions: Display and output of cut-out parts of drawings, specific items, and statistic calculation results.

Infrastructure Management System (IMS)

Then the IMS was configured using the ArcView software with Input system (Graphic input system and Attribute data input system), Management system (Urban base map IMS-Inactive database, Road IMS-Active database, Water supply IMS-Active database, Sewerage IMS-Active database, and Communication IMS-Active database), and to have the four functions of GIS described above were implemented.

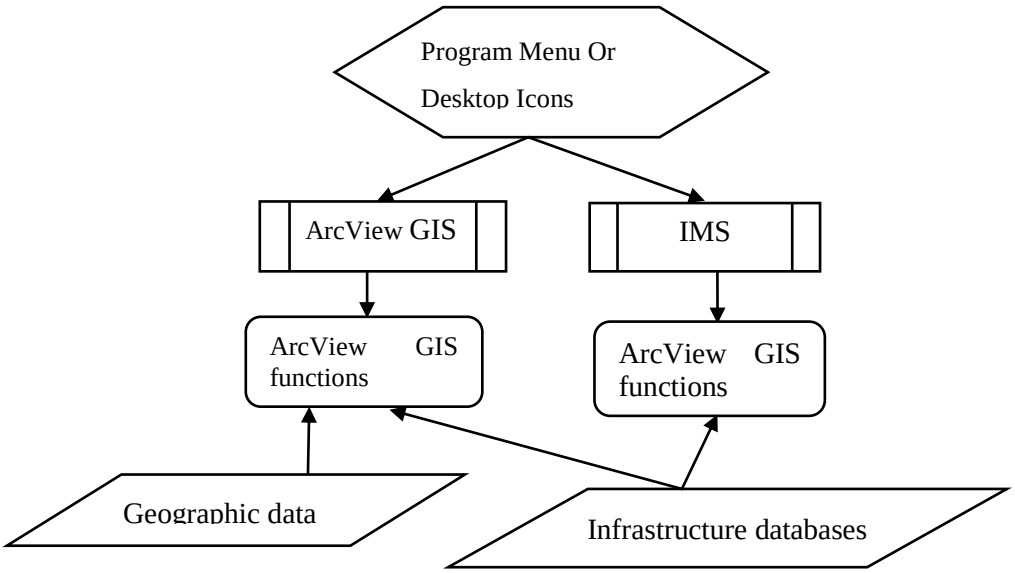

Figure 2.4. IMS Configuration

Database Development

Decision of Data Items

For the Database development, the data items were defined after the collected materials, the requirements for the facilities management, and the GIS functionality were examined. These data items for each infrastructure data were in two types, Graphic and Textual:

Road database: (Graphic data: Road center line, road width lines, section lines, etc. and Text data: Road width, road number, road structure type, etc).

Water supply database: (Graphic data: Boundary, conduits, valves, and other facilities, and Text data: Boundary name, conduit number, valve number, etc.

Sewerage database: (Graphic data: Manholes, conduits, etc. and Text data: Watershed name, manholes, conduit number, etc.)

Electricity database: (Graphic data: Facilities (such as substation), power line, poles, etc. and Text data: District number, power line number, pole number, etc.)

Communications database: (Graphic data: Manholes, poles, armored cables, distribution units, etc. and Text data: Manhole number, pole number, armored cable number, etc.)

Design of Graphic and Attribute (Text) Data

Then Graphic and Attribute (Text) Data were designed and built as follows:

- The graphic data were configured with points, lines, and polygons.
- The attribute data were defined by data type, display size, and number of characters.
- As two or more data files are used simultaneously, the required key codes were set and the relational files defined.
- The display windows for displaying graphic and attribute data were defined.

Data Entry

The neat lines for a 1/2,000 map sheet were defined on the urban base map database and the data entry was made in the neat line unit. The input base map for the graphic data was prepared from a 1/2,000 map and the data were entered in the input map and a data sheet was prepared for the attribute data which were entered in the sheet before being input in the system.

Data Quality Control

Visual and logical checks were made for each process of developing the database and the minimization of data errors was adopted as the guideline for quality control. In accordance with the above guideline, the data quality control was performed under several conditions, and various quality control methods (such as visual check, same check by two or more persons, and logical check through computer) were adopted and executed.

GIS and its Future Issues

When building the urban facilities database, it is important to specify the geographic location of each facility. Should it be otherwise, the mutual relations between the facilities would be unclear, and operating the infrastructure management system would be hard to handle. Therefore, the urban base map database (map data) used to specify the geographic locations of urban facilities constitutes an essential instrument for building the infrastructure management database.

Operation of Infrastructure Management System (IMS)

After the establishment of the IMS it has been validated though it was developed for limited number of urban facilities. However, the GIS was used and the database became a powerful tool to understand the actual conditions and execute the construction or improvement plans for the urban facilities. According to the review and discussion made on the IMS, The system will allow a suitable management of the urban facilities. However, for an improvement of the system, it is necessary to carry out the study (work study) related to the detailed works of the administrators of the facilities, the procedures of the works, and the utilization of the materials (graphic and attribute information). Taking into account the results of the study, the author, Nishimura (2012), suggested that the following issues should be treated when building an expanded database:

1. Discussions on expansion of the targets for the database development
2. Discussions on information items to be covered by the database
3. Discussions on areas to be covered by the database
4. Standardization of material forms to be prepared for the urban facilities
5. Improvement of input base maps and attribute data creation manual
6. Improvement of tools for building the database
7. Establishment of a method for systematic database quality control

Finally, Nishimura (2012) stated that a good deal of human resources will be required for the operation of the GIS that is usable for urban facilities management. The required staff could be categorized as:

• Engineers in the work-study and analysis

• GIS engineers

• Engineers in database development.

There is also another research studied about harnessing the utility of urban infrastructure asset management in Ethiopian cities and its challenges and opportunities. Nyarirangwe**,** (2008) begins by stating that urban population growth has not been matched with investment in the requisite infrastructure and services, particularly in developing countries. It is a synthesis of consultant

papers and other secondary materials, including a result of a discussion with federal government and local authority's officials. In Ethiopia, like in many developing countries, a number of urban settlements are not adequately supplied with requisite infrastructures and services. Urban infrastructure and services play a major role in development and poverty alleviation. This research mainly focused on the management of the existing stock of infrastructures.

Regarding the provision of infrastructures in Ethiopian cities, the author stated the problems in two folds. One the central government faced a serious budgetary constraint, which is the main funder of infrastructure projects of the country. Second the sub national governments are characterized by capacity challenges regarding the planning and implementing infrastructure projects. The inexistence of accurate information of the current stock infrastructures in terms of condition, capacity and level of demand is also pointed as one of the barriers to the management and planning of new proposals, including failure to attract qualified planners and engineers to carry out demand feasibility studies, infrastructure projects planning, implementation and asset management (MoWUD, 2006). Amongst many problems the author is used to explaining the poor infrastructure asset management, the major one is associated with lack of human and financial resource capacity in most of the municipalities.

The main challenge of those municipalities is lack of understanding of how to properly manage infrastructure stocks because there is no a standalone department for managing these stock infrastructures and another department with other responsibilities used to work on it. Rapid deterioration of infrastructures caused by high capacity utilization due to increasing urban population and resultant demand of infrastructure facilities and services, additionally the expensive maintenance cost. The solution recommended by the researcher are, first there is a need to establish a department with in municipalities that specifically deals with infrastructure asset management, which currently almost all municipalities do not have. Second, there is a need to use utility mapping by effectively utilizing the new CAD system. Most municipalities have established the state of art GIS and CAD systems which are not being utilized effectively.

By underlining on the high cost of investment and adverse consequences associated with poor infrastructure and service facilities, the author said there is a critical need of a proper management of existing stock. Some consequences produced of that inadequate infrastructure

management and maintaining curtail economic growth and development were also mentioned as, exposition of urban population to health risk, limited productivity due to service cut, increase in households and investor costs through property damage and increased cost of production through congestion, accidents and traffic jams. According to this researcher, most central and sub national governments (SNG) are failed not only to cop up with the dramatically increasing demand of urban infrastructures and services, but also to manage and maintain the existing stocks. The paper described the urban infrastructures in different level of details depending on their purposes and listed the physical infrastructures as transport, water and waste water, solid waste management, energy production and distribution, buildings, recreation facilities and communication facilities.

On this research, urban infrastructure management is taken as crucial because the provision has many challenges. And these challenges, including those in abroad, were presented, and the major one is that urban infrastructure investment, operation and maintenance requires a huge investment, demonstrating by Canada's municipalities as example which usually spent disproportional share construction budget on maintenance annually. The researcher strengthened his argument in the importance of infrastructure management system by reviewing some experiences of other countries and presenting the benefits.

After a thorough discussion about the current situations in Ethiopia the challenges found were;

- There is no department in most municipalities that is responsible for this specific task, and mostly departments established for some other task were working on it.
- The lack of adequate information about existing infrastructure stocks with respect to their condition, location, purpose and other attribute they posses.
- Ineffective use GIS and CAD (Computer Aided Design) systems which most municipalities in Ethiopia have already established some state of the art GIS and CAD systems.
- Lack of capacity in official working in the municipalities.

To address these challenges, the author recommended a major institutional transformation as a starting point including integrating with current federal government's urban development policies. Every municipality needs to establish a department that specifically deals with

infrastructure management. Another recommendation made by the researcher is undertaking detailed infrastructure inventories, undertaking a utility mapping by effectively using the GIS and CAD systems, capacity building were also recommended.

Harnessing the utility of urban infrastructure asset management in Ethiopian cities and its challenges and opportunities

There is also another research studied about harnessing the utility of urban infrastructure asset management in Ethiopian cities and its challenges and opportunities. Nyarirangwe**,** (2008) begins by stating that urban population growth has not been matched with investment in the requisite infrastructure and services, particularly in developing countries. It is a synthesis of consultant papers and other secondary materials, including a result of a discussion with federal government and local authority's officials. In Ethiopia, like in many developing countries, a number of urban settlements are not adequately supplied with requisite infrastructures and services. Urban infrastructure and services play a major role in development and poverty alleviation. This research mainly focused on the management of the existing stock of infrastructures.

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The main challenge of those municipalities is lack of understanding of how to properly manage infrastructure stocks because there is no a standalone department for managing these stock infrastructures and another department with other responsibilities used to work on it. Rapid deterioration of infrastructures caused by high capacity utilization due to increasing urban

population and resultant demand of infrastructure facilities and services, additionally the expensive maintenance cost. The solution recommended by the researcher are, first there is a need to establish a department with in municipalities that specifically deals with infrastructure asset management, which currently almost all municipalities do not have. Second, there is a need to use utility mapping by effectively utilizing the new CAD system. Most municipalities have established the state of art GIS and CAD systems which are not being utilized effectively.

By underlining on the high cost of investment and adverse consequences associated with poor infrastructure and service facilities, the author said there is a critical need of a proper management of existing stock. Some consequences produced of that inadequate infrastructure management and maintaining curtail economic growth and development were also mentioned as, exposition of urban population to health risk, limited productivity due to service cut, increase in households and investor costs through property damage and increased cost of production through congestion, accidents and traffic jams. According to this researcher, most central and sub national governments (SNG) are failed not only to cop up with the dramatically increasing demand of urban infrastructures and services, but also to manage and maintain the existing stocks. The paper described the urban infrastructures in different level of details depending on their purposes and listed the physical infrastructures as transport, water and waste water, solid waste management, energy production and distribution, buildings, recreation facilities and communication facilities.

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- The lack of adequate information about existing infrastructure stocks with respect to their condition, location, purpose and other attribute they posses.
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Table 1: Summary of Related Works

No	Author (year)	Objective/purpose	Methods/tools/techniques	Key findings
1	Kazumi Suwabe (2012)	• To establish an information management system in the provision of social infrastructure using GIS in order to support the development of urban facilities and services in the Dakar Metropolitan Area.	• Field study and preparation of Urban Carte: which specifies of urban issues, cause analysis, action programs and responsible departments, the necessity of data related to action planning, and the possibility of GIS applications. • Evaluation and analysis of phenomenon in urban planning and potentiality of GIS application	• Infrastructure Information database • the Infrastructure Information Management System (IIMS) included • A sub-system for urban information reference • A sub- system for urban development management • A sub-system for urban planning support • A sub-system for residentially suitable land evaluation
2	Kiyoto Hayakawa (2012)	• Establishing a geographic information system (GIS) for the efficient and effective support of land administration within the local government of DKI Jakarta	• Aerial Photography • Field Survey • Base Map-Plotting • Data Collection & Compilation • Structure Map Digitizing • GIS Layer Digitizing • Database Development Pilot Study • Application Development and Testing	• A Land Management System constitutes: • Site Measurement Application • Planning Advice Application • Planning Related Records Maintenance System • The Map Creation System • Building Footprint Update and Permit System • Parcel Maintenance System

3	Akira Nishimura (2012)	• Developing databases for urban base maps, land-use/land-condition maps, and urban facilities for Geographic Information Systems of the Capital Area of the Republic of Madagascar	• Development of guidelines • Target Urban Facilities selection • A hearing survey with the agencies related to urban facilities • Requirements analysis for Facilities Management with related agencies • Examining GIS Functions • Decision of Data Items • Design of Graphic and Attribute (Text) Data, • Review and Discussions on the IMS	• Infrastructure Management System (IMS) • Database was Developed • Functionalities of GIS • Issues that should be treated when developing an expanded database for urban facilities • Technology and human resource requirements for developing the system
4	M.Nyarirangwe, (2008)	To explore the extent to which asset management is integrated in to the digitization process for effective infrastructure provision	Reviewing consultants' report and other secondary materials on the subject matter, Discussion with federal government and local authority officials	**Challenges like**; Lack of capacity in municipalities, inefficient use of GIS and CAD systems for asset management, absence of a department that deals with infrastructure management, the being of infrastructure assets and networks are in poor state. **As a solution**; Municipalities need institutional transformation and integration with federal government urban development policies, using infrastructure asset management manual of GTZ-IS and capacity building works

2.7 Summary

This chapter presented the reviews of research reports made in land administration practices, infrastructure asset management and available technologies that suits to the problems and challenges in land and infrastructure management. Additionally, reports of assessment made on land administration system development projects in different countries were also reviewed. It also tries to bring to light previous researches on challenges and problems in land and infrastructure management with the proposed solutions.

Moreover, the intent is to find out how to use ICT (use of information, communication technologies and suitable applications) towards proposing a solution for the problems identified. Most available researches were mainly focused problems and challenges related to governance like, budgetary problems, impracticability of laws and procedures, poor and bad governance, political interference and institutional absence for some specific responsibilities. Others which are more of concerned in organizational problems and challenges like, institutional incapability, attitude of experts, and Information and ICT related ones were about inefficient use of state of the art technologies and lack of the associated equipment and trained man power in the area. The problems and challenges found out by previous researchers, especially information related ones are going to be empirically proved in this research and will be used as the basis for the formulation of a plausible solution.

Lately, literatures selected by their higher degree of relevance to this research were reviewed, and summarized with a table. The table is intended to point their objectives, methods and techniques used in the researches, and key findings and proposed solutions (if any) of the researchers.

Hence, as discussed earlier different problems and challenges regarding land and infrastructure management from variety of perspectives were attempted by some researchers. Whereas the crossing over issue has not been yet raised as a problem, most of the solutions proposed were not ICT supported and Information Systems Strategy solution for the problems and challenges highly related to information and ICT. This research attempts to explore the problems and challenges encountered due to crossing over and to propose an Information System Strategy as a solution.

CHAPTER THREE

METHODOLOGY

3.1 Overview

This chapter is aimed to describe the general research strategy and its constructs used in the research. With respect to the objective of the research, an approach that's believed to help to achieve the goal was selected. Amongst the research methodologies and approaches available a methodology best fits should be selected wisely. This wise selection depends on the type of the research to be conducted, the resources available, the purpose, the time required and the environment in which the research is to be done. The selection of a research design is based on the nature of the research problem or issue being addressed, the researchers' personal experiences, and the audiences for the study (Creswell, 2009). In this research, challenges and problems in land and infrastructure management on Addis Ababa is investigated and an integration and Information System Strategy is proposed as a solution. The selected research approach for this research and its designs with other methods and techniques used were discussed in this chapter.

3.2 General Research Strategy

3.2.1 Research Approach

As the nature of the problems declared in the introduction section of this report, there needs to observe and investigate the current situation in the bureaus where the problems are believed to be found. As stated by Kothari, (2004), case study deals with the processes that take place and their interrelationship. This research is conducted on problems and challenges in land and infrastructure management of Addis Ababa. These activities mostly take place in some specific places or organizations in the city. Therefore, the general approach of the research is a case study approach. According to Creswell, (2007), Case study research involves the study of an issue explored in one or more system boundaries. Though a case study is mostly done in a qualitative method, differently mixed methods is used in this research so that the situation in focus could be better understood.

3.2.2 Research Design

According to Kothari (2004), research design is the conceptual structure within which a research is conducted. It includes what the research is about and why?, what type of data is required and what the sample design is and techniques and methods used in collecting and analyzine the data. This research is designed to use mixed methods in a way that it incorporates the methods and techniques in both qualitative and quantitative research methodologies. Mixed method research is an approach to inquiry that combines or associates both qualitative and quantitative forms (Creswell, 2009).

Since this research is a case study, it's aimed to understand the problems and challenges in the selected organizations, and the root causes of these problems and challenges in-depth. Different literatures indicated that most research methodologies have drawbacks in exploiting every aspect of the problems attempted by researches. As Creswell (2009) said, the problems addressed by different researchers are complex and the use of either qualitative or quantitative approaches by themselves is inadequate to address this complexity. Since the problems and challenges in land and infrastructure management of Addis Ababa are complex, mixed method approach is preferred. Mixed method is an approach to inquiry that combines or associates both qualitative and quantitative forms (Creswell, 2009).There is more insight to be gained from the combination of both qualitative and quantitative research than either form by itself. Their combined use provides an expanded understanding of research problems.

Creswell (2009), described that there are six major strategies to choose from when designing a research in a mixed methodology. One of these major strategies, the sequential exploratory design is employed in this research. Sequential exploratory strategy is an approach which involves first phase of qualitative data collection and analysis followed by second phase of quantitative data collection and analysis that builds of the result of the first qualitative phase (Creswell, 2008).The qualitative methodologies is used to investigate and identify the existing problems and challenges in depth, and plausible solutions by collecting the experiences, the attitudes and the opinions of executives and experts in the area with interviews, discussions with focus group and document review. After analyzing, which is coding and themes development, the qualitative data, a questionnaire is designed. The questionnaire is to reach a wider population

and obtain additional information about the understandings, opinions and perceptions; the employees have towards the problems and challenges they encounter, and what the solution should look like. As these data have quantitative characteristics, it is used to explore and find how the problems and challenges are severe and wide spread.

Generally, according to the strategy employed here, a sequential exploratory, the qualitative data are collected and analyzed first, and the quantitative data is collected and analyzed to build on the findings of the first qualitative analysis phase.

3.2.3 Study Population and Sampling

The study population is employees in the organizations responsible for the infrastructures and the land management bureaus of the city. Some of these offices were under the federal government, like Ethio-Telecom and EEPCO. AACRA and AAWSA are other infrastructure ordering authorities accountable to the AACG. Recently, Addis Ababa Light Train Corporation (AALTC) is also established as another infrastructure ordering organ. The study population and sampling techniques and procedures are explained below.

Sampling design

As Kothari (2004), said a sample design is a definite plan determined before any data are actually collected for obtaining a sample from a given population. The sampling design preferred here is a multistage sampling design which incorporates mostly three stages. As Rahi (2017), stated Multi-stage sampling or Multi stage cluster sampling involves a sequence of stages. In this multistage sampling design both probability and non-probability sampling techniques were used since both qualitative and quantitative methodologies, which are the constructs of mixed methods approach, were employed. Multistage sampling is described by Sedgwick (2015), as it is based on structures of natural clusters within the population and different type of cluster is sampled at each stage, with the clusters nested within each other at successive stages. Rahi (2017), explained multistage sampling as follows. "*First stage is to select the sample of the entire region in cluster. The second stage is to select a specific region and at final stage to select relevant objects for sample size*". First, 4subcities are selected from the 10 subcities in the city and one infrastructure ordering authority is selected from all the organizations directly involved

in the infrastructural development and/or management of the city purposively, which is a non-probability sampling. Second, form these bureaus (first stage source list) the departments in charge for the operational activities and were believed to have a better exposure to the situation were selected again purposefully. These offices or departments were taken as strata since their working environment and job characteristics are heterogeneous. However, the internal working environment and characteristics is believed to be homogeneous for each office. Thirdly, sample individuals are selected from these bureaus (second stage source list). The final stage of sampling employed in non-probability sampling techniques for the qualitative approach and probability, which is stratified random sampling technique for the quantitative methodologies. Some literatures referred to such combined use as mixed sampling method. According to Etikan and Bala (2017), combined methods will either represent a combination of probability random sampling and non-probability sampling procedure for the selection of a sample. Etikan and Bala (2017), said purposive sampling techniques were used in qualitative research by selection of units from individuals, institutions based on a particular purpose that is associated with answering research analysis questions. Thus purposive (judgmental) sampling technique is used for the samples of qualitative data collection, while stratified random sampling from probability sampling is used for the selection of the sample individual used for the quantitative data collection. A usual sampling formula is used to determine the size to be selected from each stratum and summed up to find the total sample size. The probability random sampling, as Etikan and Bala (2017), stated it deals with quantitative adapted study that involve selection of moderately great number of units from a population, in such a system way that there will determinable of every element of the population.

Kothari (2004) stated, while developing a sampling design every researcher must pay attention to the following points step by step. These steps are: Type of universe, Sampling unit, Source list, Sample size and some more, depending on the characteristics of the study.

Universe of the Research

Since this research is made on the land and infrastructure administration of Addis Ababa, the study areas are the land management bureau in the ten subcities and other infrastructure owning and administering bureaus of the city, which are Addis Ababa City Roads Authority (AACRA),

Ethiopian Electric Light and Power Corporation (EELPA), Addis Ababa Water and Sewerage Authority (AAWSA), Ethiopian Telecommunications Corporation (ETC) and Addis Ababa Light Train Corporation (AALTC). Identifying type of universe is the first step during sampling design for a research and it means to clearly define the set of objects, technically called the universe, to be studied (Kothari, 2004). Universe of the research is the working environment that the above bureaus are working interconnected with each other.

Sampling unit

Sampling unit is basically deciding by a geographical hierarchy like a state, district… or a construction unit like a building (Kothari, 2004).As stated earlier, the bureaus in focus for this research are in Addis Ababa and working independently for the growth of the city with the responsibility of infrastructure development and management. Here the sample unit can be said the responsible organizations for the land and infrastructure management of Addis Ababa.

Source List of the Sample

Source list of a sample (also known as sampling frame) is a set from which the sample is to be drawn (Kothari, 2004). Because a multi-stage sampling design is employed here, there happened to exist multi-stage source lists as well. In the first stage of sampling the 10 subcities land administration offices and 4 infrastructure ordering authorities were the first stage source list of the sample. Offices of 4 subcities were selected out of the ten land administration bureaus, and AACRA form the 5 infrastructure developing and administering organizations. The selected 5 offices became the second source list. The land development and urban renewal offices and the "on force" design and construction department from AACRA were selected purposefully with respect to their frequent exposure to the situation in focus here. These 4 offices and the department form AACRA were the third stage source list from which the sample individuals were selected in the third and final stage of sampling with suitable techniques for each of the methodologies.

Study Population

This research partly focused on the land management, since it is vital resource for the development and management of all infrastructures. Amongst other infrastructure developing

and administering bureaus, due to the limitations, only AACRA is taken for this study. The land development and urban renewal offices of 4 subcities have 26 professional employees each and the "on force" roads design and construction department of AACRA has 61 professional employees in three lots. Totally the study population is 165 individuals from the two organizations' 5 offices, which are working in different hierarchies.

Sample Size

Sample is a descent portion of the target population that is believed to represent the universe of the study. Depending on the purpose and population size of the study an appropriate size of sample should be taken in to consideration. In addition to the purpose of the study and population size, three criteria usually will need to be specified to determine the appropriate sample size: the level of precision, the level of confidence or risk, and the degree of variability in the attributes being measured (Glenn, 2013).

Therefore, from 4 offices purposively selected from the 4 subcities, one chief executive, and one expertise officer were selected. From AACRA's purposefully selected department, one head executive and one expert are also selected with respect to their close exposure to the situation under study. Totally 5 higher executives and 5 experts, which is 10 employees were selected with the non probability, purposive sampling technique for the qualitative data collection.

For the quantitative data collection, by using the sampling formula of Chohran (1977), as cited by Singh and Masuku (2014), shown below, sample size (n = 108) determined considering a target population of 165 employees from 5 different clusters or strata. The confidence interval is taken as 5% and the confidence level to be 90%.

$$n_o = [(Z_{\alpha/2})^2 \, p \, q] / e^2$$

Where n_o is the sample size,

Zis the abscissa of the normal curve that cuts off an area α/2 (α = 0.1 equals the desired confidence level is 90%),

e = the desired level of precision, (taken confidence level = 90% where by α = 0.1)

P = is estimated proportion of an attribute in the population (taken as 0.5 and q = 1-P = 0.5; for conservative estimate)

The value for Z is found in statistical tables which contain the area under the normal curve.

$$n = n_o / [1+ \{(n_o - 1) / N\}]$$

Where n is the sample size and N is the population size.

n_o is the sample size previously found.

Finally, all the drawn samples combined together constituted the final stratified sample for further analysis.

$$n = \sum_{i=1}^{n} n_i$$

n_i: Number of sampling units to be drawn from i^{th} stratum.

Therefore, the proportional sample size from AACRA's expertise is determined to be 32 and from each subcity's land development and urban renewal office's experts are determined to be19 each, based on the percentage of the strata from the total population as presented on the table below.

Table 2: Respondent Employees' Distribution

Classification and sample size of the employees from the selected organs			
Department/office	Number of employees	Percentage of the strata	Proportional sample
AACRA's "on force"	61	36.97 %	32
Ararda S.C LDURO	26	15.76 %	19
Lideta S.C LDRUO	26	15.76 %	19
Addis Ketema S.C LDRUO	26	15.76 %	19
Kirkos S.C LDRUO	26	15.76 %	19
Grand Total	**165**	**100%**	**108**

Source: Own survey, 2018

3.2.4 Data Collection Techniques and Procedures

Data are the basic and primary input for most research methodologies. There are two types of data, which are primary and secondary data. Primary data are collected for the first time and secondary data are those which are already collected and analyzed by someone else(Kothari, 2004). As declared earlier, this research is a case study on the land and infrastructure management of Addis Ababa. Case study research is a qualitative approach in which the investigator explores a bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (e.g., observations, interviews, audiovisual material, and documents and reports), and reports a case description and case-based themes (Creswell, 2007). However the approach selected here is mixed approach of qualitative and quantitative methodologies. Thus the data collection instruments to be used are semi-structured interviews and documents review for the qualitative approach and questionnaires for the data to be used in the quantitative approach.

3.2.4.1 Semi-structured Interview

As referred by Shone (2015), O'Leary (2010) said, interviewing can be used to provide rich qualitative data and provides flexibility to explore tangents. As this research is an exploratory case study, interview is used as one of the instrument to collect the data. The interview questions were produced by adopting some formation and structure from literatures and standing on the specific objectives of this research. These questions were developed in a convenient way so that the informants provide the needed information towards the problems and challenges here in focus, and a possible way of formulating an Information System Strategy as a solution. Interviews are well suited when looking for opinions, experiences and privileged information from respondents in key positions (Creswell, 2007). This instrument is used to collect the data to be used in the qualitative analysis and applied on respondents selected, who are chief executives and experts in the area. The Interview questions checklist is attached in the annex.

3.2.4.2 Document Reviewing

Document reviewing is also another data collection technique used in this research from where secondary data inputs might be obtained. These targeted documents to the review include

proclamations of the establishment or reorganization of the organizations in the study population. The visions, missions and values the organizations were formed for, were also reviewed. Additionally policies, strategies, rules and regulations, working guidelines and manuals from the land management bureau are taken for the review. List of documents reviewed are attached in the annex.

3.2.4.3 Questionnaire

A list of questions towards the problems and challenges in the land infrastructure management were prepared referring to questionnaires used in previous researches. This questionnaire is mainly adopted from the one 'Green Surge' (2017), used in its survey study on infrastructures in European cities. Green Surge is a project launched by European Union and it was tasked to advance infrastructure planning and implementation at the city and city-regional scale. Specific objectives of our research were also considered to customize the adopted questions and to formulate some additional ones. The challenges and problems summarized in the literature review section were also considered in the preparation of the questionnaire.

This questionnaire is prepared in Likert scale and have 5 points, which ranges from 1 = strongly disagree to 5 = strongly agree. After the development of the questionnaire, a discussion has been held with some selected focus group and a pilot test was made with 10 respondents directly relevant to the issues. The pilot test was made to check whether the survey instrument were simple to understand, convenient to answer or not, and if they provided consistent and accurate information. Accordingly, modifications were made on the questionnaire items based on the pilot study respondents' feedbacks, in order to reduce bias and maximize response rate. The modification based on the feedback was somehow layout of the questions and some language usages that may create some ambiguities and vagueness, in the eyes of the respondents. The questionnaires have been spread for the selected sample population and their replays were collected in person checking for misconceptions and some deviations from the focuses of the questions, then corrected in a discussion with the respondents. The questionnaire is attached in the annex.

3.2.4.4 Data Collection Procedures

Prior to the data collection activity, after the sample frames and the sample size have been determined, the heads of the corresponding offices were met in person and requested for permission as they all are governmental organizations. This was done by explaining the objectives and purpose of the survey study, how the output of the research would contribute to the organizations and their performance improvement, and giving a word that any of their confidential internal affairs won't be exposed to anyone outside. After the permission was granted, interviews were made with the selected individuals, using the semi structured interview check list. The interviews generally took 20 to 30 minutes varying for different interviewees, but on average around 26 minutes contact hour was used for each respondent. While interviewing, some more questions were pulled out from the replies of the respondents, and used on the spot for further explanation, so that detailed information could be acquired. All the answers were voice recorded and some notes were taken, then it was transcribed to text format to be able to analyze and draw focus points for the preparation of the questionnaire.

Based on the discussion held earlier, the prepared questionnaire is used to reach a relatively wider population and obtain more data. To achieve a better response rate, handling the questionnaires in person and face to face communication was preferred in order to make clear instructions and promises of secrecy. Since the trend and experience of the employees in replying questionnaires is not previously known, 10% contingency was added and total number of 120 questionnaires was distributed in accordance with the proportion of the strata so that maximum response rate and the most possible accuracy could be achieved. Close follow up and encouragement both by phone and in person has been set up and 111 filled out questionnaires was collected within the time limit, which indicated that 92.5% of achievement in response rate. After the data has been put in to excel sheet, organized and corrected, then transferred to SPSS to code the required variables for the analysis. Data cleaning was conducted for possible omissions, missing items and errors and if there were outliers. Out of the 111 questionnaires collected 108 responses found to be usable but 3 deemed to be incomplete.

3.3 Data Analysis Techniques

The data collected in the aforementioned methods were analyzed using a mixed method approach and a strategy known as sequential exploratory. Therefore, thematic analysis and descriptive statistics technique was used for the qualitative and the quantitative data respectively.

3.3.1 Qualitative Analysis Technique

The analysis of data conducted here is thematic analysis, which is an iterative reading of the data toward discovering patterns and framing a specific research question. As Braun and Clarke, (2006) defined it, "*Thematic analysis is a method for identifying, analyzing and reporting patterns within data*". Thus, thematic analysis is used to identify, analyze and observe patterns from the responses of the employees. Furthermore, it minimally organizes and describes the data set in (rich) detail. However, frequently it goes further than this, and interprets various aspects of the research topic (Braun and Clarke, 2006). Therefore, it is also used to relate the identified themes with the research topic and interpret them towards the research questions.

For the data were from different data sources like organizations, people and documents in different techniques, it needed to be reconstructed homogeneously. The interview data was transcribed and was merged with the document review and discussion notes in cohesive continual way. After the data is rewritten and reorganized, data reduction is performed by using coding technique. Coding as the process of data reduction is an element of data organization in most qualitative approaches (Jones, et al., 2016). Conceptual code, relationship and participants' perspective code were used for this purpose. Jacqueline Jones, et al. (2016), also explained that there are different types of codes recognized in qualitative analysis and thematic analysis to facilitate coding. Which are; conceptual, relationship, participants' perspective, participants' characteristics, and setting codes. Initial codes were validated to ensure the integrity of the codes that is, they have not been misinterpreted and are free of researcher bias.

Then sub themes and themes were developed from the patterns emerged from the coded data. The themes were then refined, consolidated and named so that it can be concise, punchy and immediately give the reader a sense of what the theme is about. A theme captures something important about the data in relation to the research question and represents some level of

patterned response or meaning within the data set (Braun and Clarke, 2006). The themes and sub themes found were observed and a meaning towards the intention of the research were produced and summarized. The themes were consolidated with respect to the research questions, like the challenges and the problems, the sources of the problems, and the elements a holistic solution should possess. These major themes were connected to the quantitative analysis, on which the questionnaires were designed to focus. Some key decisions have to be made about which findings from the initial qualitative phase will be focused on in the subsequent quantitative phase (e.g themes, comparisons among groups, multiple themes) (Creswell, 2009).

3.3.2 Quantitative Analysis Techniques

The second phase analysis is in sequential exploratory strategy is the quantitative analysis. Depending on the resultant themes found from the qualitative analysis, the finding is affirmed and proven by the quantitatively how severe and wide spread the problems were. At the most basic level, the purpose of this strategy is to use quantitative data and results to assist in the interpretation of qualitative findings (Creswell, 2009). Morgan, (1998), also said this design is appropriate to use when testing elements of an emergent theory resulting from the qualitative phase and that it can also be used to generalize qualitative findings. After the data is corrected, organized and analyzed using the appropriate statistical methods and tools with SPSS, descriptive statistics methods such as frequency distribution, mean calculation, cross tabulation and graphical representations are used to summarize and present the collected data. With frequency distribution and mean was used to find out whether the quantitative analysis builds on the resultant of the qualitative analysis or not. It is used also to figure out that how much of the workers perceived and understood the problems and challenges under study. In addition to these, how the opinions of the employees matched with those obtained from the qualitative analysis is also tested.

3.4 Validation and Reliability of the Research

In order to make the research viable and decrease biases the data collected, the instrument used and the analysis methods were validated. Doing so also increases the reliability of the findings, the suggestions and conclusion of the research. As Myers (2009) points out standards for the judgment of the quality of research in terms of validity and reliability, some strategies were

adopted. First multiple techniques were used (interview, questionnaire and documents review) to the data collection so that misconception, ambiguity, vagueness and other errors could be cleared. The data sources were selected from different category types, like higher executives, professionals who have expertise in the area and other employees of the organizations as well. Reaching to all the hierarchies in the organization during data collection helps to make the determination and the survey more precise and convincing. Eriksson & Kovalainen (2008) said using multiple data sources would definitely increases the robustness of an outcome of a research.

Cronbach's coefficient alpha is broadly used as reliability criterion. Thus, in our study, since a standard survey questionnaire was not used, conducting pilot study became paramount to ensure the reliability and validity of the questionnaire items. Accordingly, pilot study was conducted prior to distributing the survey to the actual survey participants. The Cronbach's alpha coefficient (.969) indicated that the survey questionnaire is reliable since it is greater than 0.7 which is the minimal alpha value. And it is found relevant to test the reliability of each category of questions (problems and challenges, Information and ICT related causes, and an IS strategy for solution) in order to get more reliable result. Accordingly, further reliability analysis was conducted with Cronbach's alpha and the result shows that of problems and challenges registers (0.900), Information and ICT (0.842) and an IS strategy (0.925). Thus, the study is reliable based on the obtained result of the reliability tests.

The initial draft reports of the case study (data analysis results) were sent to some participants from the organizations for verification and data accuracy. Their review comments and feedback were taken in to consideration for further clarification and amendments were made. This revaluation produces further evidence, as sources and participants may remember new materials that they had blanked out during the initial data collection point (Myers 2009).

Table 3: Cronbach's alpha reliability test results

General

Reliability Statistics	
Cronbach's Alpha	No. of Items
.969	17

problems & challenges

Reliability Statistics	
Cronbach's Alpha	No. of Items
.900	6

Causes related IS

Reliability Statistics	
Cronbach's Alpha	No. of Items
.842	4

ISS solution

Reliability Statistics	
Cronbach's Alpha	No. of Items
.925	7

3.5 Strategy Evaluation Approach

Strategy evaluation has long been regarded as way of analyzing in a systematic framework the key aspects from the perspective of how well they contribute to the organization's purposes (Bovaird, 2015). Evaluation, via well-executed method, is considered as an important element of IS research process to demonstrate the utility, quality, and efficacy of a design artifact. An IT artifact need rigorous evaluation with respect to functionality, completeness, reliability, usability, fit to the organization, and other relevant quality attributes prior to using it to the intended goal (Hevner, 2004).

According to Hevner (2004), an IT artifact can be evaluated by observational, analytical, experimental testing, expert validation, and descriptive methods. These evaluation methods can be applicable depending to the type of the study at hand. In this study, expert validation and descriptive methods are used to evaluate the proposed IS Strategy. Accordingly, discussions with some individual executives were made and based on their feedbacks some modifications regarding clarity, completeness and correctness. Then, survey questionnaires were developed using example questionnaires given on the Guideline for Evaluation by Australian Development Cooperation (2009), and the evaluation criteria discussed above. The questionnaire survey was made with 15 experts, 10 from the problem area and 5 IT professionals. Moreover, descriptive method is used to describe the utility of the proposed IS Strategy by building a convincing argument for the Strategy's utility.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND FINDINGS

4.1 Overview

In this chapter, the data gathered were presented, analyzed and discussed with respect to the specific objectives of the research. As explained in the methodology section, the research strategy is a sequential exploratory which is constructed from both the qualitative and quantitative approaches. According to the strategy the qualitative data were presented, analyzed and discussed first. Then the quantitative data were presented, analyzed and discussed that builds on the resultants of the first qualitative phase. Finally based on the analysis, discussion and findings of both the qualitative and quantitative data, constructs for an Information System Strategy as a solution, were proposed.

4.2 Qualitative Analysis Result

4.2.1 Data Presentation

For the qualitative approach 10 individuals, 5 executives and 5 experts, in the area were interviewed from the purposively selected offices. The respondents were as presented below with their demographic details like educational status, work position and work experiences.

The total respondents from the offices were summarized according to their distribution within the offices.

Table 4: Respondent distribution in the offices

Offices	No of respondents
AACRA's "on force" dept.	2
Ararda S.C LDURO	2
Lideta S.C LDRUO	2
Addis Ketema S.C LDRUO	2
Kirkos S.C LDRUO	2
Total	10

Source: own survey 2018

As it can be seen on the table above, 2 employees interviewed from each office selected for this purpose. 1 head of a department and 1 senior engineer (expert) from AACRA's "on force" department, and 1 office head and 1 senior officer (expert) from the Land Development and Urban Renewal Offices of the 4 subcities surveyed.

These respondents again presented in a more detailed way with respect to their office, working positions, educational status and work experiences on current position and others. This will help to show how appropriate the representatives are.

Table 5: Respondents' demographic distribution

Respondents	Offices they belong to	Working Position	Educational Status	Work Experiences		
				on current position	Other	**total**
1st respondent	AACRA's "on force" dept.	Department head	Msc/2nd degree	8 years	10	18
2nd respondent	AACRA's "on force" dept.	Senior Engineer	Bsc/1st degree	6	2	8
3rd respondent	Addis Ketema S.C LDRUO	Chief executive	Msc /2nd degree	10	10	20
4th respondent	Addis Ketema S.C LDRUO	Senior officer	Bsc/1st degree	5	2	7
5th respondent	Ararda S.C LDURO	Chief executive	Bsc/1st degree	5	17	22
6th respondent	Ararda S.C LDURO	Senior officer	Bsc/1st degree	10	1	11
7th respondent	Kirkos S.C LDRUO	Chief executive	Msc /2nd degree	5	6	11
8th respondent	Kirkos S.C LDRUO	Senior officer	Bsc/1st degree	7	9	16
9th respondent	Lideta S.C LDRUO	Chief executive	Msc /2nd degree	4	14	18
10threspondent	Lideta S.C LDRUO	Senior officer	Diploma	3	4	7

Source: own survey, 2018

The following table summarizes the above tabular presentation with only their educational status and work experiences separately.

Table 6: Educational status

Educational status	No. of respondents
MA/Msc (2nd degree) and above	5
Bsc (1st degree)	4
Diploma and below	1
Total	10

Source: own survey 2018

Table 7: Work experience

Work experience	No. of respondents
>= 10 years	3
10 to 20 years	5
<= 20 yearsNo.	2
Total	10

Source: own survey 2018

As described in the tables above, amongst the 10 respondents interviewed, 5 have MSc degree or above. This indicated that 50 % of the interviewees are educated at least to their 2nd degree. The other 4 have BSc degree and 1 only has below 1st degree. This statistical distribution confirmed that 90% of the respondents were on appropriate educational capability both to understand and respond the questions to the expected accuracy needed for the survey. On the other hand 7 of the interviewees have been working more than 10 years, which comes to be 70 %. The minimum work experience found is 7 years, and a maximum of 22 years. This statistical presentation can guarantee that the interviewees have been working enough so that they can observe the situation, perceive the problems and challenges regarded in this research. Moreover, they are believed to be capable of contributing ideas and concepts that a solution to be proposed should incorporate. Therefore, The interview mainly focused on three basic issues, which were challenges and problems mostly encountered in land and infrastructure management, the causes of these problems and challenges as each of them perceived, and the possible solution that could be suggested in view.

4.2.2 Results and Findings

4.2.2.1 Results

Most executives responded the questions concerned problems and challenges mostly encountered in different ways but somehow near aside each other. Although these respondents raised many problems and challenges, some of those were not included since they are not the concern of this research. These were like budget related problems, leadership and political interference and others were left for future interested researchers in the area. The replies of the respondents, though they are too many to present here all, the most concise, pin pointing and generalized ones are discussed below.

Regarding the main focus of this research, almost all respondents mentioned the crossing over of infrastructures. One of them said "*if we take AAWSA and Ethio-Telecom, most of the time they dig out a road while they are working on their own. EELPA also does the same sometimes, like erecting their posts and related utilities inside the proposed roads*." When asked to explain a bit in detail, he said "*Actually, the first to bureaus might have paid a compensation estimated for the part of the roads they dismantle, but the rework is an additional burden for our organization, it*

will be usually out of our schedule and annual plan". Continuing to explain, he said "*So it needs extra resources than we proposed for the year. In addition to that, the quality of the road rebuilt in part won't be the equal to the previous status and it is preferred to be rebuild as a whole again sometimes, thus it costs us much more in every resources. Moreover, these damaged roads might be sometimes a newly built, like even less than a year. Such problems are avoidable but we've been losing tremendous amount of resources reworking and we would rather use these resources to build new roads or upgrade existing ones"*.

In a view of other infrastructure bureaus used to be appealing for damages on their infrastructures, he replied "*of course, we also encounter unexpected and unintentional damage of other infrastructures on our working sites. We used to try to assess existing infrastructures by communicating with the land development and urban renewal offices of respective subcities and bureaus owning and administering these infrastructures, to properly displace them*". This interviewee included the compensations payments by saying "*We also pay the compensation estimated by the authorized offices. Despite this fact, some infrastructure parts were found beneath the ground after the civil work has begun and would be damaged*." This respondent generalized the problems as "*these infrastructure owning and administering bureaus have a communication gap regarding their utilities and this miscommunication resulted in the mentioned problems. While building or upgrading/maintaining/expanding one infrastructure damaging another is a widely observed situation in our city and it obviously challenges the management process. All we are responsible for these problems and challenges and I believe a holistic solution need to be acted on it*".

Most of the responses were alike or mostly imparted in with the previous restatement. Another answer differently approached looks like "*infrastructure bureaus other than AACRA, like EELPA, AAWSA and Ethio-Telecom, always tries to communicate AACRA while they are going to demolish part of a road for their own activities like maintenance, expansion or upgrading. But AACRA can only give them the permission to dig up the road after they pay the estimated compensation. However, they might have found other infrastructures than a road under the ground and may damage it. This creates a conflict between the two or more bureaus, the one that damaged the infrastructure and others those their infrastructures have been dismantled or*

damaged. This results in delay, extra cost (maintenance and compensation) and quality of the infrastructures."

After concluding the challenges and problems the interview went on to wards the causes. As mentioned in the earlier responses, communication gap and miscommunication looks like to be the key part to focus on while dealing with the reasons for those problems and challenges. Most interviewees included this term in their different words, like coordination, integration, information exchange and going hand in hand. One of the replies on this point is restated as follows. "*I don't believe the infrastructure bureaus have all the information about their own infrastructures in detail and in an organized manner. Actually the communication is being tried to be held among the bureaus, but with the minimum information they possesses it is not usually achieved in a way it should be.*" One of the interviewees was an expert working in the design section of AACRA, and his opinion on the challenges and problems was found similar to the previous. Then he replied the question related to causes and reasons as "*we actually take a reconnaissance and surveying data before going to design either a new proposed road or expansion/upgrading, but I cannot be said much enough to guarantee no other infrastructure would be damaged during the construction procedures. Other data we have is the Arial photos and the structural plan of the city. By our survey, existing buildings, EELPA poles and Ethio-Telecom's poles and other parts of those infrastructures that are in the right of way of the road design to be implemented, will be found and treated accordingly with the respective bureaus. Point that we usually find only those infrastructures above the ground and no data is considered what exists beneath the earth in our design stage.*" From this explanation, we learnt that there exists a communication gap among infrastructure ordering authorities and the information used while designing or modifying a road is not adequate.

From the perspective of other infrastructures ordering authorities an executive from Land development and urban renewal office were asked, if they have ever requested for information about what the land they are intended to work on, and replied "*no one has ever asked for any information regarding what the land possesses above or beneath, except AACRA that usually needs a consistent support from our office. As the matter of fact we don't have any data with respect to infrastructures under the earth. Either the structural plan or other maps we are using in our day to day activities have only information about what exists on the land, but not beneath.*

Even if someone requests for those data, our reply would be none." Adding on this, he said "*sometimes developers, those we owe land plots also encounters some infrastructures beneath the earth while they began excavation for laying out foundation for their proposed buildings. This might create a conflict between the developers and the infrastructure ordering authorities that usually resulted loss of some resources to the developer, unexpected cost for the infrastructure owner and services malfunctioning to the community*."

A respondent from land development and urban renewal office stated that "*all the communication with AACRA is usually made via written letters and the design of roads both in soft and hard copy (using compacted disks) so that the office can work on the right of way clearance. Using this information the office estimates the compensation price for the buildings that will be demolished due to right of way and for those wholly displaced a replacement land plot will be prepared in accordance with their choice of location and the working directories and manuals. For other infrastructures affected by the proposed roads, the compensation will be estimated by the respective bureaus and displacement is also performed by them. This office, which is responsible of the right of way clearance also do not have any information about infrastructure utilities resides beneath the ground.*" Here we noticed that the information about those infrastructures that might be installed before years ago doesn't exist neither in the land development and urban renewal offices nor the ordering authorities. Even though they are trying hard, the absence of comprehensive information and the traditional means of communication they are using have made much difficult, the coordination of these offices to succeed.

An executive from AACRA said about some infrastructure ordering authorities "*another thing that makes the communication unviable is the hierarchy of the organizations involved in the infrastructure development and management. That is, some authorities like AACRA and AAWSA are directly accountable to the city government of Addis Ababa, while EELPA and Ethio-telecom are federal institutions. The communication with these federal institutions either for requesting desired information or to claim for the damaged utilities, is forced to pass through a long way. And this also costs us in time and other resources.*" Talking about communication among these infrastructure ordering authorities, it is always required for the sake of information exchange. As learnt so far from variant respondents, the root cause for the problems and challenges mostly

encountered in land and infrastructure management absence of information and traditional way of exchanging it.

The interview then proceeded to the solution aspects, which is one of the objectives of our research. Based on the problems and challenges found out and the causes believed to trigger them what possible solution could be made is tried to be exploited from the responsible and well experienced executives and experts in the area. An executive from AACRA replied in this context "*first, every infrastructure ordering authorities need to have exhaustive information about their respective infrastructures in the state of the art technology. Additionally, a convenient way of communication information exchange medium should be created among these bureaus including land administration bureau of Addis Ababa city government. I guess the regional administration and the federal government are liable bodies for this coordination.*" Another expert expressed his opinion towards the solution almost similarly with the executive's. An executive from land development and urban renewal office suggested as "*since the main source of the problems and challenges encountered is limited availability of information, especially with respect to infrastructures mostly laid or installed in the ground. I believe it is better to all the infrastructure owning and administering bureaus to have full-blown information of their infrastructure utilities. In my view, either land administration or land development and urban renewal office should be the one to gather and store all the information in an integrated way with the structural plan and other maps of the city. In this way the information will be safe, complete and accessible for all who may need it.*"

All the respondents' answers were almost the same with the above two but some have added this summarized suggestion. "*The federal institutions like EELPA and Ethio-telecom need to have either a distinct office accountable to the Addis Ababa City Government or a separate bureau which is responsible only for the respective infrastructures in Addis Ababa, though its accountability remains to be to the federal institution as it is.*" According to our respondents, the possible solution could be designed and formulated in a way that information could be available, accessible and interchangeable by and among the land administration and all other infrastructure ordering authorities. Above this, some reorganizing and/or reestablishment of the bureaus in charge is also believed to simplify the communication amongst them.

4.2.2.2 Findings

The data collected from the interviewees is transcribed and organized in a convenient way so that codes generation and themes development could be performed. The next thing is initial coding. Coding reduces the amount of raw data to that which is relevant to the research question, breaks the data down to manageable sections, and takes researchers through the transformation of raw data to higher-level insights or abstractions as the development of theme (Jones, et al., 2016). The initial codes were systematically generated from the transcribed data manually and then sorting the different codes into potential themes is done with the help of mind map. A collection of themes and subthemes were developed and refinement was done involving 2 levels of reviewing. These are, first level reviewing which is made on the level of the coded data, and second level reviewing as well was made on the level of the themes. Finally, after this iterative reviewing, a thematic map was produced and the final themes were defined and named. Themes are used as attributes, descriptors, elements, and concepts as an implicit topic that organizes a group of repeating ideas and it enables researchers to answer the study question (Jones, et al., 2016).

As a thematic analysis is looking across all the data to identify the common issues that recur, and identify the main themes that summarize all the views in the collected data (Patton and Cochran, 2007), recurring words focused in a particular cases were coded and used to develop the themes. Most of the interviewees mentioned that there are problems and challenges in their day to day activities, and the causes of these difficulties in their own different words but repeatedly. Regarding the causes, almost all of the respondents believed that lack of comprehensive information about the infrastructure utilities, especially beneath the earth, and traditional way of communication and information exchange amongst the responsible organizations are the main ones. While the questions about the possible solution they think were raised, except some a bit deviated replies, most of them believed, tackling the causes with the possible ways is the one and the only solution that can minimize those problems and challenges. ‘A theme captures something important about the data in relation to the research question and represents some level of patterned response or meaning within the data set’(Braun and Clarke, 2006). In this manner, eventually three themes were developed.

The crossing-over challenges and problems is one of the major themes defined as **Problems and Challenges**. The second major theme identified is the causes of these problems and challenges which are absence of wide ranged and all-inclusive information, the traditional way of communication and information exchange, which are the basic components of Information Communication Technology, thus labeled as **ICT and Information**. The third theme is, as it's one of the specific objectives of this research and all the responses have been heading for it, formulating **an Information System Strategy as a Solution**. How should this strategy be formulated and what constructs should it consist, has been also obtained from the analysis.

Problems and Challenges (The crossing-over of infrastructures)

According to the data from the interviewed employees, it is learnt that there are tremendous challenges and problems in the activities of the organization regarding the land and infrastructures management of Addis Ababa. Although the respondents have raised lots of diversified sort of problems and challenges, but couldn't consider all due to the specific objectives and the limitation of this research. The one which has been explained in the problem statement section, the crossing-over problems and challenges among the infrastructures is the main focal point both during the interview and also at the time of analyzing. Despite that, these problems and challenges have been mentioned now and then by the respondents during the interview. Each explained about it in different ways, but generally it means that the problems and challenges encountered most of the time in the city are breaking or dismantling other infrastructures while one works on its own. This phenomenon mostly happens with infrastructures under the surface of the earth, which belongs to Ethio-Telecom, AAWSA and sometimes EELPA as well. After the analysis, it is confirmed that these challenges and problems were known by all the organizations involved, but no one yet attempted to resolve it. The causes for the crossing-over problems and challenges according to the respondents' perception, beliefs and opinions are discussed in the next section.

Root Causes of the Problems and Challenges (ICT and Information related)

Again with the same reason explained above, there are also many other issues that were raised as causes of the problems and challenges left and the causes directly related to the crossing-over problems and challenges, with respect to ICT and information, has been considered as a major

theme. As all the respondents confirmed it, most of the information about infrastructures is not available. Most of the infrastructures ordering authorities do not have all the information of their property. Though, with the minimum information at hand, based on the pattern observed on the respondents' replies, the responsible bureaus do not usually communicate before the civil works were put into effect. Even if they try to, the traditional way of communication and information exchange is also another barrier. The other bureaus AACRA works with, regarding clearance of right of way for their new proposed roads or upgrading, is The Land Development and Urban Renewal Offices. These bureaus work on the compensation estimation for the property owners to be displaced, but only on buildings and related items. Again looking at the communication of LDUROs and AACRA in this regard, it is highly paper based, and the timing is also at the verge of civil work commencement. Generally the overall causes of the crossing-over problems and challenges were believed by all of the interviewees as the lack of exhaustive information, the traditional and late communication, and the medium of information exchange, labeled as ICT and information for this research purpose.

An Information System Strategy (as a solution)

The third major theme developed from this analysis is formulating an Information System Strategy with which the responsible organizations and CGAA need to work on to minimize or eliminate (if possible) the crossing-over problems and challenges in land and infrastructure management of the city.

As almost all the respondents have tried to indicate repeatedly, working for the availability of the comprehensive information about all the infrastructures of the city. Beside this a better way of communication and information exchange medium needed to be designed and implemented. Another problem was the timing of the so far tried communications, though in the traditional way, were too late and a prior communication amongst the accountable bureaus should be set. In general, a solution is required for the availability of information, improved way and timing of communication and technology supported information exchange medium. These can be achieved through Information System development, according to the respondents of this interview. Moreover, organizations which are directly accountable to the federal government, like EELPA and Ethio-Telecom, also need to have a distinct office responsible only for Addis Ababa city,

and for the ease communications and information exchanges with other infrastructure organs of the city. Thus, there needs to formulate an Information System Strategy as a solution, that can integrate and bring those organizations together towards developing an Information system.

From the discussion above based on the most relevant replies, it has been confirmed that the problems and challenges do really exist, are very usual and prominent in the organizations. Just as explained in the themes earlier, the causes of these problems and challenges were also perceived by almost all of the interviewees, but it's believed to be unavoidable with to the extent of their capacity, degree of power and limited responsibilities. Because, based on the root causes of the problems and challenges, what most employees think to be a solution needs a cooperative effort amongst all the responsible bureaus. And also they strongly and repeatedly insisted the development of Information System which requires involvement of the central government of the city and the federal government as well. The key findings of the qualitative analysis made so far are;

- The main causes of the crossing over of infrastructures, problems and challenges, are highly related with information and communication among the organizations;
- Integration and harmonization of the infrastructure ordering organizations among themselves and with the land management bureaus is required based on factual information of the utilities;
- Legislative information policy that enforces communication and information exchange prior to the planning and implementation of their infrastructure assets;
- An Information System Strategy is imperative and need to be formulated mainly focusing on:
    - availability of exhaustive information of all the infrastructures, and
    - ICT supported communication and information exchange medium.
- Provision of convenient way of communication and technology supported information exchange amongst the organizations

4.3 Quantitative Analysis Result

The data used here were also gathered from the random employees of the purposively selected organizations and work sections in them. The demographic information, like educational status,

work position and experiences, of the sample individuals were collected to ensure that they are relevant enough to the subject of the survey. Their data are presented in this section. Then their replies were categorized, analyzed and the findings were summarized after a thorough discussion.

4.3.1 Data Presentation

Though the sample size determined in the methodology was 108, 120 questionnaires were distributed to ensure maximum response rate and most possible accuracy. However, only 108 questionnaires were found to be complete and usable. The distributions of the respondents by their offices, work experiences and educational status are presented here after.

Table 8: Respondents Distribution by Offices

		Frequency	Percent	Valid Percent	Cumulative Percent
	AACRA	28	25.9	25.9	25.9
	ARADA LDURO	18	16.7	16.7	42.6
	ADISKETEMA LDURO	21	19.4	19.4	62.0
	KIRKOS LDURO	24	22.2	22.2	84.3
	LIDETA LDURO	17	15.7	15.7	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

All the employees in the sample were engineers by profession, since they were selected, though randomly, from the purposely selected departments and offices. Regarding their distribution in the selected offices, their work experiences and educational status, are presented below.

Table 9: respondents distribution by their work experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20 yrs and above	18	16.7	16.7	16.7
	10 to 20 years	55	50.9	50.9	67.6
	10 years and below	35	32.4	32.4	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

As it can be seen from the tabular summary, 50.9 percent of the respondents have worked between 10 to 20 years and 16.7% of them worked more than 20 years. Though the rest 32.4 % have less than 10 years of work experience, they may still have enough exposure to the problems so that they can contribute useful information to the survey. However, the 67.6% of the employees, who have been working for more than 10 years, are experienced enough to understand the problems and challenges the organizations are facing. They are also able to suggest a possible way of tackling and/or resolving these problems and challenges. The overall distribution of the sample is believed to be satisfactory for the reliability of the survey on the information they provide.

Table 10: Respondents Distribution by their Educational Status

	Educational status	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MSc and above	13	12.0	12.0	12.0
	1st degree	57	52.8	52.8	64.8
	Diploma and below	38	35.2	35.2	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Coming to the educational status, around 54% have studied up to 1st degree level, and 13% were having their 2nd degree. The remaining 33 % are labeled as either Certificate or Diploma holders. However, they are yet believed to perceive the situation around them and have contributed a lot to the data collection since most of these employees are there because they have relatively a better work experience. But generally, 67% of them are holding above 1st degree. This proportion of the work experiences and educational status can be helpful to the survey believing that they are capable of understanding the questions, replaying accurately, and are supportive to the purpose of the study. For ease of visualizations Distribution of Respondents viewed on the tables above are graphically presented in fig 4.1 to 4.3 below.

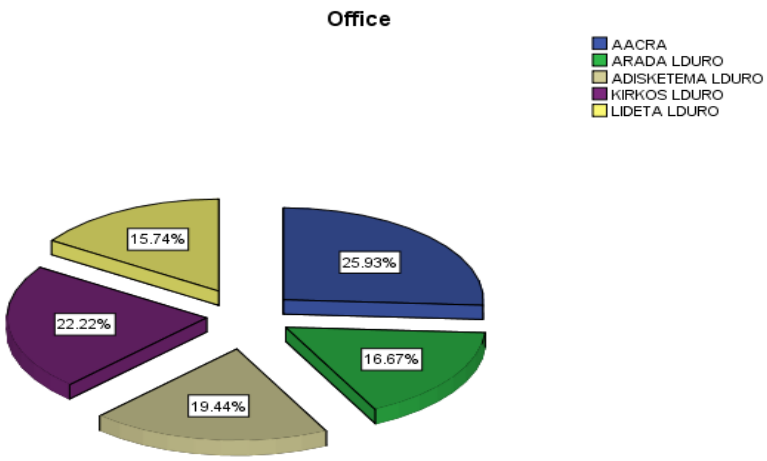

Figure 4.1: employees' distribution by their organization

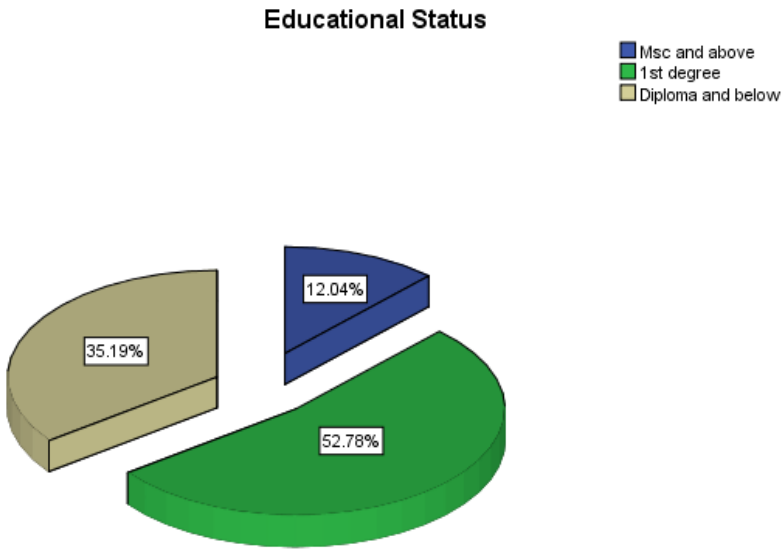

Figure 4.2: employees' distribution by their educational status

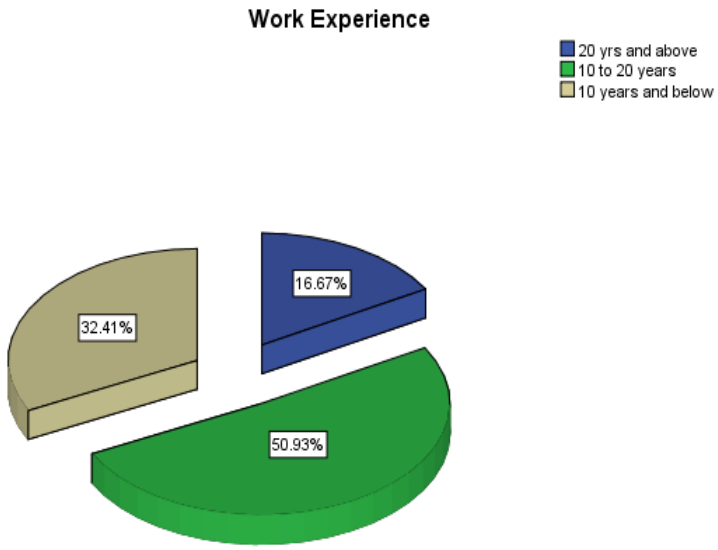

Figure 4.3: employees' distribution by their work experiences

The respondents from all 5 organizations in their educational status, work experiences and their working positions were used to show how diversified they are. Thus, this multivariate data collection helps for the reliability of the information obtained. The employees in each bureau with those different characteristics are cross-tabulated using SPSS version 20 and the output is presented as follows.

Table 11 : Office * Educational Status Crosstabulation

		Educational Status			Total
		MSc and above	1st degree	Diploma	
Office	AACRA	3	14	11	28
	ARADA LDURO	2	10	6	18
	ADISKETEMA LDURO	3	11	7	21
	KIRKOS LDURO	3	13	8	24
	LIDETA LDURO	2	9	6	17
Total		13	57	38	108

Source: own survey, 2018

Table 12: Office * Work Experience Crosstabulation					
		Work Experience			Total
		20 yrs and above	10 to 20 years	10 years and below	
Office	AACRA	4	14	10	28
	ARADA LDURO	3	10	5	18
	ADISKETEMA LDURO	3	10	8	21
	KIRKOS LDURO	5	12	7	24
	LIDETA LDURO	3	9	5	17
Total		18	55	35	108

Source: own survey, 2018

Table 13: Office * Job Position Crosstabulation					
		Job Position			Total
		Management	Higher Expert	Officer	
Office	AACRA	3	13	12	28
	ARADA LDURO	2	7	9	18
	ADISKETEMA LDURO	2	5	14	21
	KIRKOS LDURO	2	4	18	24
	LIDETA LDURO	2	3	12	17
Total		11	32	65	108

Source: own survey, 2018

4.3.2 Result and Findings

As the sequential exploratory strategy is used in this research, the quantitative data are collected after the qualitative analysis has been done, and the questionnaire was developed adopting an approach from previous survey on infrastructures and standing on the findings of the qualitative analysis. In sequential exploratory strategy, quantitative data collection and analysis is the second phase that builds of the result of the first qualitative phase (Creswell, 2008).The defined themes in the previous analysis are the problems and challenges (crossing-over of infrastructures), causes of the problems and challenges (information and ICT), and an Information System Strategy as a solution. The questionnaire was redesigned, developed and some more questions were added to them after the finding of the themes in the qualitative analysis. Based on the themes found, the questions were categorized into three parts. Therefore, the sample individuals have replied in Likert scale, for those questions. The replies are

organized, corrected and arranged in excel sheet, the copied to SPSS. Statistics tool of Descriptive analysis on SPSS was used to analyze and present the quantitative data.

Problems and challenges (the crossing-over of infrastructures)

In this theme, six questions were prepared and the distribution of the replies of the employees their inclination was analyzed and presented below in tables.

Table 14: responses On "organs have significant problems and challenges"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	45	41.7	41.7	41.7
	Agree	54	50.0	50.0	91.7
	Neutral	5	4.6	4.6	96.3
	Disagree	3	2.8	2.8	99.1
	strongly disagree	1	.9	.9	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 15: responses On " land management is vital in infrastructure management and development"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	46	42.6	42.6	42.6
	Agree	43	39.8	39.8	82.4
	Neutral	10	9.3	9.3	91.7
	Disagree	4	3.7	3.7	95.4
	strongly disagree	5	4.6	4.6	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 16: responses on "there is no smooth communication among stakeholders"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	38	35.2	35.2	35.2
	Agree	49	45.4	45.4	80.6
	Neutral	10	9.3	9.3	89.8
	Disagree	4	3.7	3.7	93.5
	strongly disagree	7	6.5	6.5	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 17: responses on "organizations usually damages other infrastructures, while developing their own"					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	28	25.9	25.9	25.9
	Agree	44	40.7	40.7	66.7
	Neutral	22	20.4	20.4	87.0
	Disagree	8	7.4	7.4	94.4
	strongly disagree	6	5.6	5.6	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 18: responses on "other organs damage your infrastructure doing their own"					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	45	41.7	41.7	41.7
	Agree	37	34.3	34.3	75.9
	Neutral	19	17.6	17.6	93.5
	disagree	4	3.7	3.7	97.2
	strongly disagree	3	2.8	2.8	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 19: responses on "the crossing over highly affects the development t of infrastructures of the city"					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	34	31.5	31.5	31.5
	Agree	55	50.9	50.9	82.4
	neutral	18	16.7	16.7	99.1
	Disagree	1	.9	.9	100.0
	Strongly disagree	0	0	0	
	Total	108	100.0	100.0	

Source: own survey, 2018

According to the tabular representation of the replies for every questions related to the problems and challenges, 91.7 %, 82.6 %, 80.6 %, 66.7 %, 75.9 % and 82.4 % of the respondents either agreed or strongly agreed on the issues raised, respectively. In average 36.4% were "strongly agree" and 41.5 % were "agree". This implied that by average 79.95 % of the respondents agreed to the existence of the problems and challenges, the crossing over and the effects of these

problems on the development and management of infrastructures. Those who were disagreed, in both choices, are only 7.1 %, while around 13 % were neutral or not sure or didn't know at all that the problems and challenges exist. These respondents were those who have little or no exposure to the circumstances being surveyed, and considered as outliers in this research. In general, regarding the questions about the problems and challenges, the respondents highly leaned towards an agreement; the aggregate mean (mean of means) is 4.06. This result highly assists to conclude that these problems and challenges are prominent in the organizations and affects the development and management of infrastructures of the city; that builds on the finding

Table 20: problems and challenges (distribution percentage and mean)

Problems and challenges related questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	mean
Existence of the problems and challenges	0.9	2.8	4.6	50.0	41.7	4.29
land management is vital in infrastructure management and dev't	4.6	3.7	9.3	39.8	42.6	4.12
There is no smooth communication among stakeholders	6.5	3.7	9.3	45.4	35.2	3.99
if the organ damages other infrastructures, doing its own	5.6	7.4	20.4	40.7	25.9	3.74
other organs damage your infrastructure doing their own	2.8	3.7	17.6	34.3	41.7	4.08
The crossing-over highly affects the devt. Of the city's infrastructure	0	0.9	16.7	50.9	31.5	4.13
Mean of mean						4.06

Information and ICT Related Causes

This category of questions was Information and ICT, which is the second theme defined during the qualitative analysis, and found to be the main reason why those problems and challenges mostly encountered by the organs. There were four questions in this regard and the replies were analyzed as follows.

These questions tried to build the absence of information about the infrastructures of the city and the unwise use of ICT as the source of those problems and challenges. As shown on the tables below, here again most of the replies were positive, though a bit decrement is observed.

Table 21 : responses on " Unavailability of enough information in the organization"					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	46	42.6	42.6	42.6
	agree	43	39.8	39.8	82.4
	neutral	10	9.3	9.3	91.7
	disagree	4	3.7	3.7	95.4
	strongly disagree	5	4.6	4.6	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 22: responses on "Organs don't gathering information before the civilworks begins"					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	38	35.2	35.2	35.2
	agree	49	45.4	45.4	80.6
	neutral	10	9.3	9.3	89.8
	disagree	4	3.7	3.7	93.5
	strongly disagree	7	6.5	6.5	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 23: responses on "communication and technology supported medium of information exchange among the bureaus is poor"					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	28	25.9	25.9	25.9
	agree	44	40.7	40.7	66.7
	neutral	22	20.4	20.4	87.0
	disagree	8	7.4	7.4	94.4
	strongly disagree	6	5.6	5.6	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 24: responses on "Information and ICT can be used to solve problems and challenges"					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	45	41.7	41.7	41.7
	Agree	37	34.3	34.3	75.9
	Neutral	19	17.6	17.6	93.5
	Disagree	4	3.7	3.7	97.2
	strongly disagree	3	2.8	2.8	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Here also 82.4 %, 80.6 % and 87 % of the respondents agreed or strongly agreed to the questions on the causes of the problems and challenges, which are absence of information, poor concern for information and lack of communication respectively. 75.9 % of them also agreed on the potential that information system and ICT can support the solution. On average, 76.4 % of the replies were found to be in agreement, which were 36.5 % and 40.05 % for "strongly agree" and "agree" choices respectively. The neutral answers were 14.15 % only and the rest were 4.6 % and 4.9 % for "disagree" and "strongly disagree" in their order, which summed up to be 9.5 % of all.

Table 25: Information and ICT (distribution percentage and mean)

Information and ICT related questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	mean
Unavailability of enough information in the organization	4.6	3.7	9.3	39.8	42.6	4.12
Organs don't gathering information before the civilworks begins	6.5	3.7	9.3	45.4	35.2	3.99
medium of information exchange among the bureaus is poor	5.6	7.4	20.4	40.7	25.9	3.74
Information and ICT can be used to solve the problems and challenges	2.8	3.7	17.6	34.3	41.7	4.08
Mean of mean						3.98

Source: own survey, 2018

In this category, the aggregate mean (mean of means) found is found to be 3.98 and this showed that the respondents tendency towards the agreement on the sources of the problems that it's highly related to information and ICT. This indicated that the main causes of the problems and challenges in concern were the absence of information and the poor usage of ICT in the organizations, which also strengthened the findings of the qualitative analysis in this aspect.

An Information System Strategy as a solution

The final group of questions were focused on the importance of an Information System Strategy to resolve the problems and challenges, how to formulate, what sort of issues it needs to incorporate and who should take the responsibility to develop it. Accordingly seven questions were answered by the respondent employees and each was analyzed as follows.

Table 26: responses on "The problems and challenges can be resolved with use of Information and ICT"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	38	35.2	35.2	35.2
	Agree	49	45.4	45.4	80.6
	Neutral	10	9.3	9.3	89.8
	Disagree	4	3.7	3.7	93.5
	strongly disagree	7	6.5	6.5	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 27: responses on "Availability of Comprehensive information and communication media should be one component of the solution"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	28	25.9	25.9	25.9
	Agree	44	40.7	40.7	66.7
	neutral	22	20.4	20.4	87.0
	disagree	8	7.4	7.4	94.4
	strongly disagree	6	5.6	5.6	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 28: responses on "Every organization needs to have all the information about its infrastructure assets"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	45	41.7	41.7	41.7
	Agree	37	34.3	34.3	75.9
	Neutral	19	17.6	17.6	93.5
	Disagree	4	3.7	3.7	97.2
	strongly disagree	3	2.8	2.8	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 29: responses on "Land management bureaus should have all the information about infrastructures"					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	34	31.5	31.5	31.5
	Agree	55	50.9	50.9	82.4
	Neutral	18	16.7	16.7	99.1
	Disagree	1	.9	.9	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 30: responses on "accountable body for the integration and information management is required in the solution"					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	46	42.6	42.6	42.6
	Agree	43	39.8	39.8	82.4
	Neutral	10	9.3	9.3	91.7
	Disagree	4	3.7	3.7	95.4
	strongly disagree	5	4.6	4.6	100.0
	Total	108	100.0	100.0	

Source: own survey 2018

Table 31: responses on "CGAA should play the major role in the development of the information system as strategic solution"					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	38	35.2	35.2	35.2
	Agree	49	45.4	45.4	80.6
	Neutral	10	9.3	9.3	89.8
	disagree	4	3.7	3.7	93.5
	strongly disagree	7	6.5	6.5	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Table 32: responses on "An Information System Strategy is very important and need to include information collection and technology supported information exchange and communication"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	28	25.9	25.9	25.9
	Agree	44	40.7	40.7	66.7
	Neutral	22	20.4	20.4	87.0
	Disagree	8	7.4	7.4	94.4
	strongly disagree	6	5.6	5.6	100.0
	Total	108	100.0	100.0	

Source: own survey, 2018

Since the root causes of the problems and challenges was defined to be information related, and also as the interviewees in the qualitative data collections insisted, the solution to be proposed needs to address these strong demand of information and technology supported information exchange and communication of the stakeholders. Therefore, an Information System Strategy highly focuses on information collection and storage, integration and the communication technologies. Not only this, but also prior communications and information exchange among the organs involved, was also suggested to be included in the proposal of the solution. Each questions examined all the issues weighed in the opinions, perceptions and beliefs of the employees interviewed, and result found from the questionnaires looks like in the tables above. Statistically, 76.46 % of the respondents, in average, have either agreed or strongly agreed to the questions about the solution strategy. 34 % were answered "strongly agree" and 42.46 % of them replied "agree". The resultant implied that the responses of the participants in the questionnaire tend to agree on the attainability of the solution and the components defined to be constituents of a holistic strategy; the aggregate mean found here is 3.97.The 14.71 % of the employees preferred not to say agreed and disagreed, but remained being neutral. This outcome also builds up the finding stated after the qualitative analysis.

Table 33: An Information System Strategy as a solution (distribution percentage and mean)

An Information System Strategy as a Solution related questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	mean
The problems and challenges can be resolved with the use of Information and ICT	**6.5**	**3.7**	**9.3**	**45.4**	**35.2**	**3.99**
Availability of Comprehensive information and communication media should be one component of the solution	**5.6**	**7.4**	**20.4**	**40.7**	**25.9**	**3.74**
Every organization needs to have all the information about its infrastructure assets	**2.8**	**3.7**	**17.6**	**34.3**	**41.7**	**4.08**
Land management bureaus should have all the information about infrastructures	**0**	**0.9**	**16.7**	**50.9**	**31.5**	**4.13**
accountable body for the integration and information management is required in the solution	**4.6**	**3.7**	**9.3**	**39.8**	**42.6**	**4.12**
CGAA should play the major role in the development of the information system as strategic solution	**6.5**	**3.7**	**9.3**	**45.4**	**35.2**	**3.99**
An Information System Strategy is very important and need to include information collection and technology supported information exchange and communication	**5.6**	**7.4**	**20.4**	**40.7**	**25.9**	**3.74**

Source: own survey, 2018

4.4 Documents Review

Another data was gathered from documents relevant to the issues and the organizations in charge. To observe and analyze with the findings of the previous data, the visions, missions and goals of the stakeholders, proclamations of their establishments, the federal urban development policy, and policy and strategy of urban land development was reviewed.

4.4.1 Results

Both ACCRA and LDURO's vision, mission and goal is cascaded from the general vision and mission of the AACG. The vision of Addis Ababa City Government is to make the city a suitable habitation for the dwellers and a capital of Africa, more over one of the diplomatic cities of the world. Its mission is to have a clean, beautiful and habitable city that is well developed socially,

economically and physically. According to the information obtained from the discussion held with the employees, the respective bureaus took their part from these abstracts which are often introduced and expanded on the annual plans every year.

The urban development policy, (2005), says "*the main goal of provision and development of Infrastructures is to ensure rapid development of the cities. And this should be done in an economically feasible way*." it also says, "*for the urban land development, and development and provision of infrastructures, all the stakeholders, the hierarchical government bodies and city administrations need to play their role by leading in an integrated way according to the master plans of the cities*."

Regarding infrastructures, the urban land development policy and strategy, (2003) clearly stated that "*to accelerate urban growth and development, roads, train ways, telecommunication, electric power grid and water splay and sewerage networks should be installed. This infrastructure installation mainly requires land. These infrastructures are not only the economic infrastructures* (hard infrastructures)*, but also the social infrastructures* (soft infrastructures)."

The urban land development and management policy execution techniques and capacity building package, (2003) restated this again as "*to facilitate a sustainable urban land development, infrastructures should be fulfilled strictly based on the principles of environmental protection and economical utilization. Urban land development needs to be harmonized and integrated with infrastructure development*." Though this implementation package for the urban land development policy and strategy says this, it didn't make a clear way how to achieve this integration and harmonization.

4.4.2 Findings

The bureaus responsible for infrastructure development and management, the Land Development and management bureau and AACG has found to have the same vision mission and goal, though they are working on different responsibilities to contribute to the success of theirs and AACG's vision, mission and goal. The urban development policy, and the urban land development and management policy and strategy also have induced integration and harmonization for urban land development and infrastructures development& provision. The executing package for the policy

and strategy also reinforced the integration and economic way implementation. However as the survey result indicated that there is wastage due to compensation, delay and other resources for conflict managements. This is obviously uneconomical and doesn't support the policy and strategy statements. The problems found were mainly caused by lack of all-inclusive information, poor and traditional way of communication and information exchange and others are failures with regard to the policies direction in terms of harmonization and integration.

4.5 Summary of results and findings

Generally, from the documents review, it is found that the visions, missions and goals of all the bureaus under the municipality are cascaded from the broader visions, missions and goals of AACG. Infrastructure development and provision for the city of Addis Ababa is also one of the goals of other infrastructure ordering authorities under the federal government. The policies and strategies related to urban development, urban land development and management, and the implementation packages also stated harmonized and integrated coordination amongst the stakeholders of infrastructure development and management. The qualitative data analysis indicated that problems and challenges in urban land and infrastructure management and development are prominent. The major causes and sources of these problems and challenges are absence of complete information, poor and traditional way of communication and information exchange of the responsible bodies, and inexistence of distinct responsible institution for the integration. On due the analysis, it is disclosed that an Information System a possible way of addressing these problems and challenges from their root causes. Finally the quantitative data analysis also built on these findings and results. Hence the following suggestions were made.

4.6 Development of an Information System Strategy

Strategy is, according to Chen et al. (2010), a high-level plan which consists of some sort of consciously intended course of actions. It describes how the ends (goals) will be achieved by the means of resources. Strategy is important because there are always different sort of barriers in ways towards some predefined goals, mainly resource limitedness. Previous researches indicated that existing policies and strategies of Ethiopia has provided a framework for sustainable development. Of course the Urban Development Policy of Ethiopia, (2005), and also others like the urban land development policy and strategy, (2003) and the urban land development and

management policy execution techniques and capacity building package, (2003), stated that the major target of infrastructure development and provision is to ensure rapid development and it should be performed in an economical use of resources. These policies and strategies also suggest that it should be done in an integrated and harmonized way of all the stakeholders and hierarchies of the government. The increasing use of infrastructure asset management has prompted the need to understand the processes involved and craves a fully integrated approach directed for gaining greatest lifetime utilization, effectiveness and value from infrastructure assets (Too, 2008).

Information System Strategy is a highlight description of the extent to which a modern, complex organization depends on information and technologies, in all of its guise, and to consider how this strategic assets should be managed (Hanson, 2011). From researches in the area it has been proved that an appropriate IS strategy helps to justify investments on IT and, at the same time, increase performance, effectiveness and competitive advantages. Based on the findings and results of this research, the root causes of the problems and challenges related to crossing over were identified and an Information System Strategy is proposed as a solution. The goals and objectives, processes to be supported by the system, the expected roles and responsibilities of the respective authorities and other requirement of the solution constituted The IS Strategy. As Too (2008) said, infrastructure asset management strategy's goals and objectives arrived at should be as a result of the interactions and consensus between various stakeholders.

This Information System Strategy is organized into a matrix form by using Earl's (1989) triangle model for a strategy and Pollack's (2010), IS strategy matrix (see annex A, table 34). The matrix representation consists the elements of the IS Strategy and answers the questions of what, who, how and where. Detailed description of this IS Strategy attempted to further explain the matrix representation regarding the elements, the stakeholders, their roles and responsibilities, the hardware and software suggestions, and the IT governance issues with respect to information safety and security. After the description of the matrix, the effort towards it and the impact expected from the IS Strategy is indicated and presented in figure (see annex A, fig 8).

Generally the contents of the IS strategy were derived from the empirical data, government policies and strategies, and reviewed literatures. Therefore, the directions put in the policy and

strategies of the country on Urban Land Development and Provision of Infrastructures, which is economical use of resources and an integrated leadership of authorities and working in harmony, is used as a guideline in the development of this IS Strategy, to identify the responsible organizations and their expected roles and responsibilities. Additionally, from the empirical data obtained from the survey, the root causes of the problems were focused since one of the specific objectives of this research is to propose a solution for those problems. The findings and results of the research attributed to the IS Strategy regarding the focus area of problems, the root causes to tackle in order to solve the problems and the means of communication and information exchange. In addition to these, who should be the participants, who to play the major role, the type of information needed, how and who to collect the information, where and how to store it were also transformed from the results and findings of the research. Literatures were also contributed a lot in its formulation and identifying the constructs of the IS Strategy. Suitable and convenient applications and technologies proposed in this IS Strategy were extracted from the reviewed literatures. Besides, the quality of the information to be used, the security and safety issues with regard to the information were also found as a result of the reviewed literatures. The proposed IS Strategy is attached in Annex A.

4.7 Evaluation of the proposed IS Strategy

4.7.1 Strategy Evaluation Approach

Bovaird (2015) explained about strategy evaluation criteria of Rumelt (1980), which are consistency, consonance, advantage and feasibility, lately have been reduced in to three by Johnson and Scholes (2002), namely towards feasibility, suitability and acceptability. As Bovaird (2015) explained, consistency and consonance were merged in to suitability and advantage has quite a close match with acceptability during the reduction. Hevner (2004) as well stated that an IT artifact can be evaluated in terms of fit with the organization, functionality, completeness, reliability, usability, and other relevant quality attributes.

An IS Strategy, as an IT artifact, needs to be evaluated in order to demonstrate its quality, utility and efficacy. This helps to improve the IS Strategy in to ensure the quality of the proposed solution so that it can solve real world problems (Hevner, 2004). The evaluation of the strategy then provides feedback information and a better understanding of the problem in order to

improve both the quality of the system and the design process. In this study, expert validation was used to evaluate the proposed IS Strategy along with descriptive method, among other like observational, analytical, experimental and testing approaches.

Expert validation is chosen to gain different views of the experts who work in the problem area and have contributed to this study in different positions. Moreover, majority of the experts have ample years of experience in the land management and infrastructure development and management position which adds value to their holistic view of the proposed IS Strategy. It is also believed that it can help to evaluate the IS Strategy whether it fits to the organizations or not. According to Hevner (2004) fit to the organization can be one of the criteria to evaluate an IT artifact.

The first round of expert validation was a held in discussion with individuals selected based on their closeness to higher management. The aim of this discussion is to check that the IS Strategy is whether in line with the organizations' policies and strategies or not. Additionally, it was objected to review the first draft of the IS Strategy with respect to its completeness, correctness, and clarity; and identify possible improvement opportunities from their feedbacks. Based on the experts' feedbacks, the proposed IS Strategy was revised to improve its completeness, clarity and correctness.

After revision of the proposed IS Strategy, a second round of expert validation was conducted through a questionnaire shown in Annex H with a wider group of experts to gather individual evaluation of the improved IS Strategy regarding the comprehensiveness completeness, clarity and usability of the revised IS Strategy. In this phase, additional IT division employees were invited to participate on the survey by providing a brief explanation regarding the proposed IS Strategy. The content of the questionnaire is derived from the evaluation criteria recommended by Hevener (2004) which consists of fit to the organization, comprehensiveness, reliability, clarity, correctness, and usability quality attributes.

The questionnaires were distributed in person with a brief description with an attachment of the copy of the revised IS Strategy. Then phone calls and in person visit was mad to encourage the respondents to fill up the questionnaire timely. Subsequently, the respondents were further encouraged to provide their genuine feedbacks through their personal cell-phone. Accordingly,

all the invited 10 participants completed the survey. Hence, the response rate of the IS Strategy evaluation survey is 100%. The survey data is entered to excel and then copied to SPSS software for analysis purpose. The evaluation result is further analyzed in the next section.

4.7.2 Evaluation result of the proposed IS Strategy

In order to evaluate the consistency of the survey, Cronbach's alpha reliability test is applied and the result is depicted in table 34. The value of the coefficient alpha (0.823) indicates that the survey is reliable since it is greater than 0.7.

Table 34: Reliability Statistics based of the Proposed IS Strategy

Reliability Statistics	
Cronbach's Alpha	N of Items
.823	15

Descriptive analysis (mean and standard deviation) of the survey result is computed as can be seen in table 35. The mean result of the evaluation variables is found to be greater than 3 which indicated that the respondents agreed on the clarity, completeness, usefulness, correctness of the proposed IS Strategy. The overall rating of the proposed IS Strategy (mean of means) is 4.30 which can be taken as the whole contents of the IS Strategy have been agreed by the experts. This shows that the IT experts participated on the evaluation survey confirmed the completeness, correctness and clarity, and applicability of the proposed IS Strategy.

Table 35: Mean and standard deviation of the IS Strategy Evaluation Survey

Descriptive Statistics					
	N	Min.	Max.	Mean	Std. Dev.
The proposed IS Strategy is comprehensive in terms of coverage	15	2.00	5.00	3.80	0.862
The organization and presentation of the IS Strategy is suitable.	15	4.00	5.00	4.60	0.507
The objective of the IS strategy is comprehensible.	15	4.00	5.00	4.80	0.414
The content of the proposed IS Strategy is clear.	15	3.00	5.00	4.40	0.632
The content of the proposed IS Strategy is correct.	15	4.00	5.00	4.80	0.414
The content of the proposed IS Strategy is complete.	15	2.00	5.00	3.60	0.828
The proposed IS Strategy is applicable.	15	4.00	5.00	4.67	0.488
The proposed IS Strategy is in line with the policies and strategies of the stakeholder organizations	15	2.00	5.00	4.13	0.743
The implementation of the proposed IS Strategy can improve the Land and Infrastructure Management of Addis Ababa.	15	3.00	5.00	4.20	0.676
Overall rating of the proposed IS Strategy and Mean of means	15	3.11	5.00	4.33	0.618
Valid N (listwise)	15				

The completeness of the proposed IS Strategy scored the lowest mean value (3.60) among all quality attributes used to measure the IS Strategy. This indicates the need for further improvement of the IS Strategy to ensure the completeness of its content. Similarly, the comprehensiveness of the framework in terms of its coverage needs further improvement as it scored the second lowest mean result (3.80) as can be seen in table 35.

The evaluation result indicated that, the correctness of the IS Strategy has the highest mean value (4.80) which revealed that majority of the experts strongly agreed to it. Similarly, the understandability of the objective of the proposed IS Strategy are strongly agreed by majority of the experts with mean result of 4.89. The correctness and understandability shows the applicability of the IS Strategy and it can be easily converted to practice in the organization. In terms of the applicability of the IS Strategy, the mean result (4.67) tends to the category of 'strongly agreed' by the majority of the experts.

Thus, the results of correctness, understandability, and applicability revealed the validity of the IS Strategy to be implemented in the Land and Infrastructure Management of Addis Ababa in order to address the Crossing-over of infrastructures and other information related problems.

4.8 Summary

In this chapter, the data collected were presented with respect to their different characteristics and categories. For both the methods employed in this research, the data presented, analyzed and results and findings were drawn. First qualitative data were analyzed, discussed and the findings of the analysis were stated. Then questionnaires were developed adopted its approach from previously conducted survey, and based on the developed themes from the results of the qualitative analysis, and considering the specific objectives of this research, the questionnaires were formulated. The data collected using these questionnaires, were presented, analyzed, discussed and findings and results were extracted. The findings of the quantitative analysis found to build up the results and finding of the qualitative analysis. Even though variety of problems and challenges were raised in land and infrastructure management of Addis Ababa, the one and major problem and challenge was found to be the crossing over of infrastructures that pulled back the development and provision of infrastructures of the city. The root causes of this problems and challenges also found to be lack of exhaustive information of infrastructures, poor and traditional way of communication amongst the responsible stakeholders and absence of integrity in their work processes.

Therefore, there needs to find a solution that can:

- Make the information needed available and accessible,
- Support the communication and information exchange with ICT, and
- Establish integration and harmony in the work of the organizations.

In order to address these suggestions an Information System Strategy is proposed which is derived from the findings and results of this research, directions of the policies and strategies covered by document review section, and literatures reviewed. The development process of the proposed Information System Strategy and its constructs were explained. Finally, the evaluation approach used and evaluation results were presented and discussed.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

This final chapter of the research report presents the conclusions drawn from the study, some suggestions and recommendations for practice and future researches based on the evidences presented during the course of the study.

5.1 Conclusion

As it is an information era the technologies related to information and communication, including internet, are drastically booming up. Following this growth of the technology most of the cities in developed and developing countries have changed the way they manage their infrastructure assets and urban land towards variety of information systems. Obviously information science has played the vital role in such transformations from traditional ways of doing things to modern and information technology based services and activities. Though it is not possible to say that these services and activities are flawless, the problems and challenges mostly encountered during the previous systems are significantly reduced due to the results of information systems, which is by utilizing the current information technology and suitable applications.

Addis Ababa is one of the major diplomatic cities of the world, also for Africa and the capital city of Ethiopia. Besides that, it is one of the fastest growing cities in the world. However, the infrastructures and its management are not yet where it is expected to be. As it is widely known, the major infrastructure ordering authorities of the city are AACRA, EELPA (currently EEPCO), AAWSA, Ethio-Telecom and the recently added AALTC, among them EEPCO and Ethio-Telecom are governed by the federal government and the rest are under the AACG. Despite the difference in their scope, all are currently working in the development and management of their respective infrastructure in Addis Ababa. In addition to these bureaus, since the main resource for urbanization is land, AACG's land management bureau is also involved in the development and management infrastructure.

According to the urban development policy, (2005), The Urban Land Development Policy and Strategy, (2003), and The Urban Land Development and Management Policy Execution

Techniques and Capacity Building Package, (2003), of Ethiopia and its capital Addis Ababa, the infrastructure development and management should be performed in economically feasible way with integration and harmony.

Practically, the infrastructures development and management of the city cannot be said it is economical, integrated and harmonized. One of the major problems here is the crossing over of the infrastructures each other that costs most of the organizations considerable amount of resources. Thus, it is important to explore the problems and challenges laid here and their major sources in an effort to contribute for the development of a holistic solution.

In order to do so, problem questions related to the major sources of the problems and challenges, what a possible solution can be proposed and the way how the organizations could be integrated were raised in this research. A mixed method of qualitative and quantitative approaches is chosen in which sequential exploratory strategy will be used. Regarding the issue of concern of this research, extensive literature review was made and unstructured interview questions check list was prepared. AACRA and Land Management Bureaus of AACG from 4 subcities were selected for this research purpose. After the qualitative data collected from those bureaus, preliminary analysis was made and by referring some literatures, a questionnaire was constructed. The quantitative data analysis has built on the results and findings of the qualitative data analysis. Additionally, some policies, strategies and working manuals were also reviewed and from the cumulative findings and results the following conclusions were drawn.

From all of the data sources, interview, questionnaire and documents review, it is found that there are problems and challenges most of the infrastructure ordering bureaus usually faces that abide them to achieve the expected infrastructure development and management level of the city, as directed by the existing policies, strategies and manuals. Though there are lots of problems found during the survey, the major one is the crossing over of infrastructures mostly occurred while building new or upgrading/expanding the existing ones. The main sources of such problems and challenges, according to the study, are lack of comprehensive information about the infrastructures in the city, the poor or traditional way of communication and information exchange, and absence of distinct responsible body for their integration.

The problems and challenges found and confirmed to be prominent in the land and infrastructure management of Addis Ababa are believed to be resolved with an Information System that can create a platform for integration and harmony among the stakeholders by storing exhaustive information about the infrastructures and providing a convenient way of communication and information exchange. Therefore, from the findings and results of the analysis of the data obtained from informal discussion with the executives and experts in the area, interview and documents review, a high level IS Strategy is proposed. In addition to these, reviews of literatures on land and infrastructure asset management, suitable technologies and applications available, challenges related to land and infrastructure management and the information systems triangle have contributed a lot. The high level Information System Strategy proposed as a solution is attached in Annex A.

5.2 Recommendations

Based on the findings of this study and the conclusions drawn, the following recommendations are forwarded for practice and knowledge (further research).

5.2.1 Recommendation for Practice

It is know that information is one of the most valuable resources any organization could have, even it is said that information is the second most resources next to human. Decision made on more information at hand will incur no or little risk, but decisions made with no or little information have higher risk. Thus, the authorities, the managements and employees of these organizations need to have enough, complete and relevant information before making any decisions. So, the results and findings of this research may be used as an indication that the current problems and challenges they are facing can be avoided with the proper use of information and communication technology.

Authorities of the AACG and Federal government can use this Information System Strategy to develop the road map for the Information System development that will be a holistic solution for the problems and challenges mainly caused by either the absence of information or improper utilization, and poor way information exchange and communication. It also can help them as reminder and indicator that the existing policies were not practiced as stated and it needs further

detailed strategies containing course of actions how the economical feasibility, integration and harmonization can be achieved. The top managements of the bureaus can use these results and findings to convince the importance of complete information, proper communication and technology supported information exchange among the bureaus. It may also help the respective authorities to revise the policies, rules and regulations due to their impracticality.

Even in their own capacity they will get an insight how to solve or at least minimize the crossing over problems by communicating their equivalents in other concerned bureaus. Until the integration succeeds they also can direct their subordinates and use their effort to gather every information, store, utilize and exchange with others when needed.

Employees in the design team can also get some preventative measure tips to their jobs. Like to consider, at least, the available information and the possible best communication and information exchange with other relevant bureaus, before designing both new infrastructure and/or expansion/upgrading projects.

5.2.2 Recommendation for future work

This research has its own scope and limitations, and the problems and challenges of the area are a bit vast than expected, interested researchers can find a strain to pull out and use for their research topics. However, some suggestions are extended here under.

- **Urban Land Information Management system**

The land management aspect is raised here in this research because every infrastructure is strongly related to land. But currently, the land management bureau has launched a land management system which is Geographic Information System (GIS) based, and it can be studied by itself for its impacts, usage and performance in both the system itself and the experts working with it.

- **An Integrated Infrastructure Management Framework**

A high level Information System Strategy is proposed in this research. But there could be also a possibility to develop a framework for the integrated infrastructures information management system. Interested researchers might be able to develop the integrated system itself.

- **Extension on the results of this research**

Since one time survey was done in this research and found some short comes in completeness and coverage, further research and improvement is highly recommended for interested bodies in the area. Moreover**,** there could be also uncovered instances in this research that might be important and needed to be considered in the development of the Information System Strategy. Exploiting in more depth to find additional elements needed to be included in this proposed solution.

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ANNEX A: IS Strategy for the Addis Ababa Land and Infrastructure Management

Introduction

As an output of the research effort, this Information System Strategy is developed based on the findings from empirical data and literature review. The document begins with brief overview on information systems strategy following with objectives and matrix representation of the strategy.

Among their five definitions Chen et al. (2010) have given to Strategy, the first one defines it as a plan, some sort of consciously intended course of actions. Developing a strategy involves assessing one's current situation and developing a shared vision for where they want to be. The focus of Information System Strategy is on alignment with business needs and provides a link between organizational demand and information technology. According to Oktavia (2014), Information System Strategy must be aligned with the organizations perspective toward business model and should be compatible with its organizational strategy that consists of fundamental elements of business. This Information System Strategy is conceived as an overarching and inclusive plan that consists of the broad set of principles along with a range of process-specific strategies. And it follows that the process of developing and managing this parent strategy will require an inclusive approach, with the process owner (each organization) working with the information services or IT department and any other identified sources of expertise in the matters at hand. In other words, this strategy should have its own dedicated information strategies (or substrategies), setting out the extent and nature of their dependency on information resources and a consideration of how they are managed.

IS strategy defines the organization's requirement or demand for information and system to support the overall strategy of the business functional. Thus, as Oktavia (2014) stated, the most common aims organizations implementing an IS/IT strategy are:

- Aligning IS/IT with the business process to identify where IS/IT major contributes and determines priorities for investment
- Obtaining competitive advantage from opportunities created by using IS/IT applications
- Building cost effectiveness, with implementation of technology infrastructure for the future, and
- Sharing knowledge to the appropriate resources and competencies to deploy IS/IT successfully across and among the organizations.

The remaining part of the document includes goals and objectives, matrix representation of the IS strategy with description of roles and responsibilities, the impact of the IS expected in the content subsection and a conclusion.

Objectives/ Goals of the Information System Strategy

As a strategy is a direction or course of actions to be taken to achieve a predefined goal, it can be also defined as description of the path from the 'As-Is' situation where particular organization or domain currently is, to the 'To-Be' situation or desired improved future state (Todorovski, 2006). This path can be represented in the following figure.

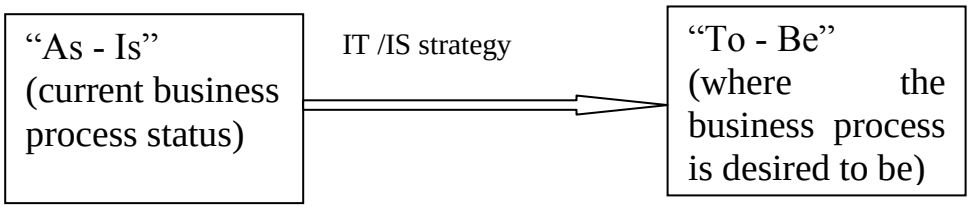


Figure 1: IT/IS strategy: description of the path from "As-Is" to the "To-Be" ICT situation

The purpose of this Information Systems Strategy is to get the processes in AACG and the organizations in focus from where they are now to where they are desired to be.

As referred by Chen et al. (2010), Earl (1989) proposed a management strategy for IS organizations which consist of three sub domains (the *triangle model*): (1) *what* has to be done; (2) *how* does it have to be done; and (3) *who* should do it. Earl (1989) labels these three sub-domains as IS, IT, and IM (information management) strategy, respectively. Thus, this ISS is basically defines what should be done, how and who should do it. Specifically it has the following nine goals:

Goal 1: To identify, posses and use trusted information;

Goal 2: to direct appropriate collection and Access to information resources;

Goal 3: Support increased transparency and Organizations engagement;

Goal 4: Support Integration and Harmonization;

Goal 5: Legislated compliance;

Goal 6: Clarity regarding roles, responsibilities and accountability;

Goal 7: Improved information risk;

Goal 8: propose hardware and software used to manage information and communication;

Goal 9: to suggest the tools to access, package, deliver and communicate information.

Content/ matrix representation of the strategy

Emphasizing on drawbacks of the major processes identified, there needs exhaustive information collection. There also needs a safe and secured storage for the information, internet service and networking equipments, software and applications compatible with the data type, controlled access mechanisms and governance over the integration. By combining Earl's triangle model cited by Chen et al. (2010) with Pollack's (2010), IS strategy matrix, the proposed strategy elements are presented below.

Table 36: Information System Strategy for Land and Infrastructure Management System. (*Adopted from Pollack's matrix and Earl's triangle model*)

	What	Who	How	Where
Hardware	computers, printers, scanners	AACG for the data repository, Responsible departments and offices, involved organizations in the integration	Using existing hardware if they fit Purchasing the rest	Repositories will be centrally placed in a responsible office, other hardware components will be in every organization
Software	DBMSs, AutoCAD, ESRI's ArcMap, ArcIMS, ArcGIS, Intergraph's Geomedia Webmap	Trusted vendors, In-house IT professionals, Government institutions like: INSA, ministry of Science and technology	webGIS, internet GIS development base maps like: MapServer Scalable Vecto Graphic (SVG) Interfaces can be developed by using PHP, HTML and XML programming languages web applications. Internet Map Server (IMS) using ArcXML programming	Software that supports Geospatial data and DBMS will be on the central computer, interfaces and web applications will be on every computer in every organization and also on the main computer
Networking	servers, routers, switches, rack, network cables.	ISP, (Etio-telecom), In-house IT professionals, Government institutions like: INSA, MoST	Internet services will be provided by ISP (Ethio-telecom), Networking can be done by: In-house IT professionals, Government institutions like: INSA, ministry of Science and technology	In every organizations involved in the integration
Data	Information of the urban land, The road network of the city, Water supply and sewerage collection lines, Internet and telecommunication grid, Electric power lines and other utilities, All in AutoCAD and ArcGIS format.	All infrastructure ordering organizations are responsible for the information of their assets, land management bureau, system administrator	Every infrastructure ordering authorities collect their own information, Land management contributes the information at hand, Data represented in different layer with the help of such software, Information overlaid and stored with DBMS, MIS	In the main repository

All the organizations involved in this strategy are expected to play their roles for the successful implementation of this strategy. As the main player, AACG is expected to create a platform and employ detail analysis on the types of the processes which need to be supported by the information system to be developed towards setting up the road map. This can be achieved by coordinating a team from each organizations or assigning the tasks for each responsible organization depending on their functional responsibilities. It also need to held iterative discussions and consultations until a consensus is reached with them on the road map of the development. The hardware specifications will be defined after the analysis of the processes and the size and types of the data/information to be collected and stored. The provision of the data repository is also the responsibility of AACG. But each organization taking part in the integration needs to prepare the required hardware components in accordance with their individual requirements.

The software widely used, as it's been observed in previous researches, ESRI's Geographic Information Systems (ArcGIS), Internet Map Server (ArcIMS) and Intergraph's Geomedia Webmap can be used, since most of the data are geospatial and may need to be Geo-referenced. For the information storage and management, DBMS software like, Microsoft SQL Server and Oracle's can be utilized. A program interface between modules and GIS operation tools can be programmed in JavaScript and the user interface can be developed by PHP, HTML and XML programming languages. These applications and interfaces development can be performed by internal IT professionals, or by external companies.

The major connectivity engine, the internet service is obviously will be provided by the Internet Service Providers (ISPs), in our case Ethio-telecom. Other network equipments and infrastructures can be obtained from different companies working in the area. The installation and configuration work also can be done by the in-house IT professionals or external companies.

The major input for the development is information.

Thus, the information of every infrastructure utilities will be gathered, cleaned and organized by each organization for their respective assets. Then it will be prepared in different layers, with the help of software that supports such layering, like ArcGIS, and overlaid in one to be stored in the main repository. The other related information, like type of infrastructure, status (new, old, …), size, material made of, and the likes, of the infrastructures referenced by coordinates (X,Y, Z) and stored in the DBMS with linked to their specific location. The AACG will take the responsibility

to collect the organized information of all the infrastructure organizations develop the Integrated Land and Infrastructure Information Management System that can be accessible from each of the organizations by the assigned and authorized person.

Another important thing to consider here is governance over quality and security of information stored in the main repository. Any information that is available for sharing need to be well defined and appropriately accessible (allowing for necessary safeguards), the quality of information should fit for the intended purpose (e.g., accuracy, currency, consistency, completeness), and all staff must know and exercise their responsibilities toward information(Hanson, 2011).Such principles *of information management* should be employed and governed by the AACG.

- Information should be integrated across systems such that managers or decision makers can model the processes of every organization through data and not be constrained by demarcation lines and associated issues of data ownership.
- Corporate data should be owned by AACG, not by any single section or department. Data should not be duplicated. There should be a single version of the truth
- Data quality standards should be defined and measurable, with consistent vocabulary and definitions applied to all corporate data and information elements.
- Information should be appropriate and fit for its purpose.
- Information should be openly available and accessible; in a convenient and readily usable manner such every organization can do their work and fulfill their roles in the most effective manner possible.
- All information management activity should comply with relevant legal and ethical requirements, including but not limited to data protection, freedom of information, and copyright.
- Data should be secure according to defined levels of sensitivity and confidentiality.

Information systems have become integral, online, interactive tools deeply involved in the minute-to-minute operations and decision making of organizations. According to researches over the last decade, information systems have fundamentally altered the economics of organizations and greatly increased the performance and efficiency of organizations that implemented successfully. The major contributors of the information system are management, organizations

and technology. The impact expected from supporting the processes of these organizations with an IS is mainly a better performance and tried to show in the figure below.

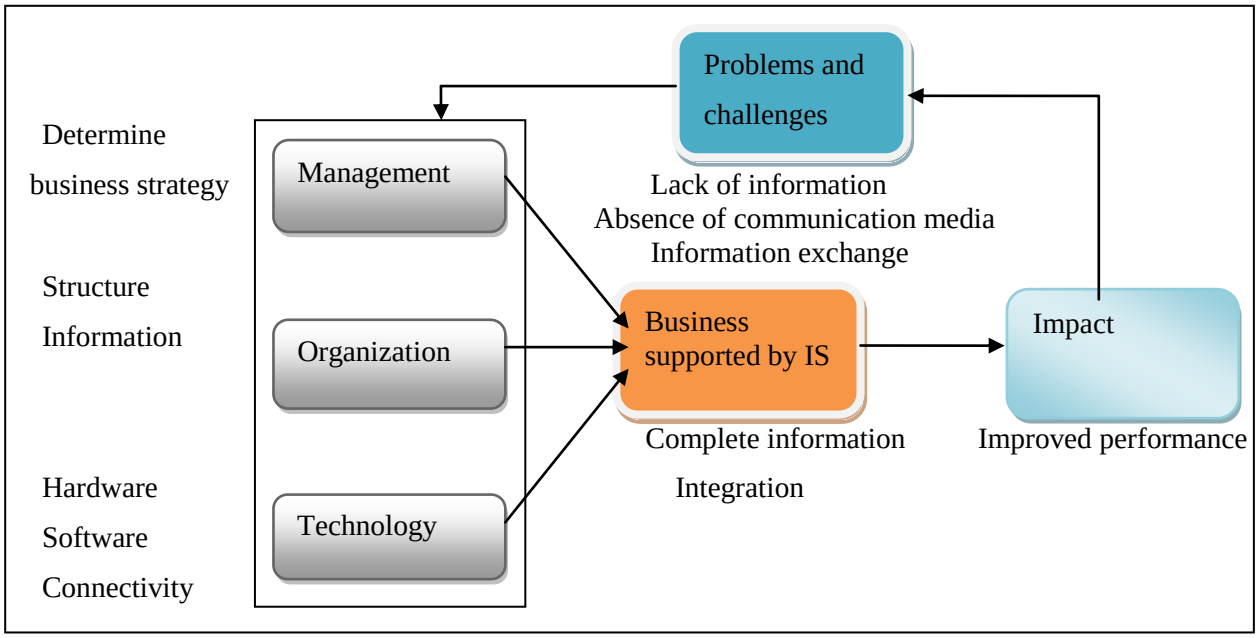


Figure 2: effort in supporting the processes with IS and its impact

Conclusion

Because of the wide possibilities opened up by today's IT capabilities, IS functionalities and information use, business organizations are given every chance to determine what and how they wish to accomplish through IT. Organizations need to choose the appropriate IS and IT strategies to justify their IT investments and, at the same time, increase their performance, effectiveness and competitive advantages.

As it is stated earlier, this strategy is a high level proposal and intended to establish integration and harmony among the infrastructure organizations. Since these organizations have different working environment, culture and organizational structure, however they all share the vision and mission of AACG, the may need to develop sub strategies depending on their own dependencies and line of authority they follow, but as an integral part of this parent strategy. This strategy, in turn, provides the basis for developing the Implementation Plan needed to carry out the strategy. This implementation plan will specify the resources (people, money, facilities), technology, programs, and projects required to achieve the objectives. It is in this plan that we find specific quantitative targets and schedules.

ANNEX B: Questionnaire Addis Ababa University

School of Graduate Studies College of Natural Science

Department of Information Science

Dear sir or madam

This survey is conducted as a data input for an academic research at Addis Ababa University School of information science for the partial fulfillment of Degree of Masters of Science in Information Science. The objective of the survey is to assess the existing problems and challenges and their causes in Land and Infrastructure management of Addis Ababa city. Then to find out what could be the impact of information and what possible solution could be proposed. No individual or organizational information is publicized as your answers will be dealt as statistical figures only.

I would like to thank you in advance for your dedication, kind participation and on time and genuine responses.

Feel free to contact the person below for any technical problems or any questions regarding the content of the questionnaire.

Fasil Bekele

fasilb@gmail.com

mob.No. +251911646769 / +251911485898

General(demographic and organizational)

1. name of the organization
2. Your profession
3. your role in the organization chief executive ○ expert/officer ○
4. This organization has involvement in infrastructure development/management of Addis Ababa? Yes ○ No ○
5. Years of experience in the organization
6. Educational status Msc or above ○ Bsc/1st degree ○ diploma and below ○
   a. In the same position

      (specify the position and work experience in years)
   b. In different position

      (specify the position and work experience in years)

Simple instruction

Please indicate what you appropriate responses to the statements by circling on the respective numbers using the following associations.

1=Strongly disagree,

2=Disagree,

3=Neutral,

4=Agree,

5=Strongly agree

A, Challenges and problems (crossing-over of infrastructures)

	Strongly disagree	disagree	neutral	agree	Strongly agree
1. The organization has significant challenges and problems in its activities towards the infrastructure management Addis Ababa.	1	2	3	4	5
2. Land management has a vital role in infrastructure development and management of the city.	1	2	3	4	5
3. The organization doesn't have a smooth communication with other stakeholders in its day to day activities.	1	2	3	4	5
4. The organization usually damages/dismantles other infrastructures while building/expanding/ upgrading its own.	1	2	3	4	5
5. Other organizations usually damages our infrastructure while developing/expanding/ upgrading theirs	1	2	3	4	5
6. This crossing over among infrastructure ordering organizations highly affects the development on infrastructures in the city.	1	2	3	4	5

B, Information and ICT

	Strongly disagree	disagree	neutral	agree	Strongly agree
7. The organization doesn't have every detail information of the infrastructure it possesses.	1	2	3	4	5
8. The organization doesn't usually gathers all the information about other infrastructures resides on the	1	2	3	4	5

sites before it begins its activities on the siets.					
9. The organization hasn't a good medium of information exchange with other concerned bureaus.	1	2	3	4	5
10. Do you think the problems and challenges in the land and infrastructure management can be tackled by using information communicatin technology (ICT).	1	2	3	4	5

C, An Information System Strategyas a solution

	Strongly disagree	disagree	neutral	agree	Strongly agree
11. The operational problems and challenges like, crossingover can be resolved with use of Information and ICT	1	2	3	4	5
12. The organizations can get rid of those challenges and problems, if detailed information of every infrastructures is collected, stored and integrated or a platform is created for a smooth communication and information exchange.	1	2	3	4	5
13. Information about every infrastructure should be collected and stored by each organization.	1	2	3	4	5
14. Every information about the infrastructures should be collected and stored with the land information of the city by the land management bureau.	1	2	3	4	5
15. Accountable body for the integration and information management is required in the solution	1	2	3	4	5
16. The regional government should play the major role in the development of the information system as strategic solution to avoid the problems.	1	2	3	4	5
17. An Information System Strategy is very important and need to include information collection and technology supported information exchange and communication	1	2	3	4	5

Thank you!!

ANNEX C: Check List for Unstructured Interview Questions

General

1. The name of the organization
2. Personal role (position of the interviewee) in the organization.

Organizational

3. The role of the organization in development and management of infrastructures in the city.
4. Personal contribution in the organization regarding infrastructure management.
5. What are other stakeholders in the activities of the organizations?

Challenges and problems

6. What are the challenges and problems encountered in the activities of the organization?
7. What do you think the causes of those challenges and problems?
8. Does the organization have damaged or dismantled other infrastructures while building/upgrading/ expanding its own? And vice versa? If yes, which organizations mostly?

Information and ICT

9. Does the organization have every detail information about the infrastructures it orders?
10. Does the organization gather information about other infrastructures reside on the sites it works on its own infrastructures? How?
11. How is the communication and information exchange between the organization and other stakeholder bureaus is exercised usually?
12. What problems and challenges encountered in information exchange among the bureaus?

As a solution

13. How do you think this crossing over amongst infrastructures could/should be tackled?
14. What do you think your organization, the regional administration and the federal government should do regarding these challenges and problems? Like developing a holistic strategy.

ANNEX D: Questions versus Specific Objectives Matrix

Types of questions in the questionnaire and interview	Specific objectives			
	Investigate the existing problems in land and infrastructure management of Addis Ababa.	Identify the problems on infrastructures management due to lack of information, its storage and integration/exchange.	Identify basic elements of a an Information System Strategyfor land and infrastructure management of Addis Ababa.	Formulate and Evaluate the strategy
What are the challenges and problems encountered in the activities of the organization?	✓			
What do you think the causes of those challenges and problems?	✓			
Does the organization have damaged or dismantled other infrastructures while building/upgrading/ expanding its own? And vice versa? If yes, which organizations mostly?	✓	✓		
How do you think this crossing over amongst infrastructures could/should be tackled?			✓	✓
Does the organization have every detail information about the infrastructures it orders?	✓	✓	✓	
Does the organization gather information about other infrastructures reside on the sites it works on its own infrastructures? How?	✓	✓	✓	
How is the communication and information exchange between the organization and other stakeholder bureaus is exercised usually?		✓	✓	
What problems and challenges encountered in information exchange among the bureaus?	✓	✓	✓	
What do you think your organization, the regional administration and the federal government should do regarding these challenges and problems? Like developing a holistic strategy.			✓	✓

ANNEX E: List of Documents for Review

1) Establishment and/or reorganization proclamations
   a) The Addis Ababa city Government Immovable property Registration and Information Agency establishment proclamation, Proclamation No .22/2010.
   b) Ditto but amendment proclamation No. 24/2010
   c) A Proclamation to Provide for the Amendment o f the Addis Ababa City Government Executive and Municipality Services Organs Re-establishment, Proclamation No. l5/2009
   d) Ditto but amendment Proclamation No. 27/ 2011
   e) The Addis Ababa City Government Executive and Municipal Service Organs Reestablishment Proclamation
   f) Proclamation No. 1712004Addis Ababa City Master Plan Preparation, Issuance and Implementation Proclamation
   g) Proclamation No. 80/1997Ethiopian Road! Authority Re-establishment Proclamation
   h) Addis Ababa City Roads and Transport Bureau resettlement policy framework
2) Urban development policy of Federal Democratic Republic of Ethiopia
3) Urban land development and management policy and strategy of Federal Democratic Republic of Ethiopia
4) Urban plan preparation and implementation strategy of Federal Democratic Republic of Ethiopia
5) The urban land development and management policy execution techniques and capacity building package

ANNEX F: Initial Coding

Transcribed replies	Initial codes
The construction/upgrading of the roads on the site of the work physically in different time and at different stages. **Though it's not that integrated,** the offices try to do their job **by communicating and exchanging the necessary information using paper based and sometimes CDs.** Actually, the first bureaus might have **paida compensation estimated for the part of the roads they dismantle**, but the **rework is an additional burden for our organization**, it will be usually **out of our schedule and annual plan**. So **it needs extra resources than we proposed for the year**. In addition to that, **the quality of the road rebuilt in part won't be the equal to the previous** status and it **is preferred to be rebuild as a whole again** sometimes, thus **it costs us much more in every resources**. Moreover, **these damaged roads might be sometimes a newly built**, like even less than a year. Such **problems are avoidable** but **we've been losing tremendous amount of resources reworking** and we would rather use these resources to build new roads or upgrade existing ones. we **also encounter unexpected and unintentional damage of other infrastructures** on our working sites. We used to **try to assess existing infrastructures communication with** the land development and urban renewal offices of respective subcities. these infrastructure owning and administering bureaus **have a communication gap** regarding their utilities and **this miscommunication resulted in the mentioned problems**. While building or upgrading/maintaining/expanding **one infrastructure damaging another is a widely observed situation** in our city and **it obviously challenges the management process**. All we are **responsible for these problems and challenges** and I believe a **holistic solution need** to be acted on it **I don't believe the infrastructure bureaus have all the information about their own infrastructures in detail and organized manner**. Actually the **communication is being tried to be held among the bureaus**, but with the **minimum information they possesses** it is **not usually achieved** in a way it should be. Point that we **usually find only those infrastructures above the ground** and **no data is considered** what exists beneath the earth in our design stage. This might **create a conflict between the developers and the infrastructure ordering authorities** that usually resulted lose **of some resources to the developer**, **unexpected cost for the infrastructure owner and services malfunctioning to the community**. **AACRA and AAWSA are directly accountable to the city government of**	**not integrated** **communicating and information exchanging** **using paper & CDs** **paida compensation** **the roads they dismantle** **rework** **additional burden** **extra resources** **quality of the road rebuilt** **costs more resources** **damaged roads** **problems are avoidable** **losing resources** **reworking** **damage on other infrastructures** **assess existing infrastructures** **others damaging ours** **communication** **communication gap** **miscommunication** **resulted in problems** **not having information detail and organized** **among bureaus** **minimum information not achieved** **data not considered** **conflict b/n orgns** **unexpected cost** **malfunctioning** **accountability** **damaged utilities** **forced to pass through long way** **responsible for these problems and challenges** **holistic solution need**

Addis Ababa, while **EELPA and Ethio-telecom are federal institutions**. The **communication** with these **federal** institutions either for requesting **desired information** or to claim for the **damaged utilities**, is **forced to pass through a long way**. And this also **costs us in time and other resources**." very infrastructure ordering authorities **need to have exhaustive information** bout their respective infrastructures in **the state of the art technology**. Additionally, a **convenient way of communication information exchange nedium** should be created among these bureaus including land administration ureau of Addis Ababa city government. I guess the **regional administration** and he **federal government are liable** bodies for this **coordination.**" since the main source of the problems and challenges encountered is **limited availability of information**, specially with respect to infrastructures mostly lied or installed in the ground. I believe it is better to all the infrastructure owning and administering bureaus to have **full-blown information of their infrastructure utilities**. In my view, either **land administration or land development and urban renewal office** should be the one to **gather and store all the information in an integrated way** with the structural plan and other maps of the city. In this way **the information will be safe, complete and accessible** for all who may need it. The **federal institutions like EELPA and Ethio-telecom** need to have either a **distinct office accountable** to the Addis Ababa City Government or **a separate bureau** which is responsible only for the respective infrastructures in Addis Ababa	**cost time & resource** **having exhaustive information** **stat of the art technology** **communication medium** **information exchange medium** **regional admin** **federal gov't** **coordination** **limited availability of information** **full-blown information** **gather and store all the information integrated way**

ANNEX G: Theme Development

Initial codes	Sub-themes	Themes	Major themes
Compensation **roads they** **dismantle** **additional burden** **extra resources** **quality of the road** **rework** **rebuilt** **costs more resources** **losing resources** **damage of other infrastructures** **resulted in problems** **not achieved** **conflict** **unexpected cost** **malfunctioning** **damaged utilities**	Damage in infrastructures of one another Unexpected extra expenses Decreased quality Rework Malfunctioning Unable to achieve goals	Damages Loss of resources Unsuccessfulness	Problems and challenges (mainly crossing over of infrastructures)
not integrated **traditional way of communication and information exchange** **communication gap** **miscommunication** **resulted in problems** **not having information assess existing infrastructures** **not having information detail and organized among bureaus** **minimum information** **data not considered** **forced to pass through long way** **communication medium** **information exchange medium** **limited availability of information**	Unavailability of complete information Traditional way of communication Poor usage of communication technology Poor usage of information	Lack of Information Poor Communication Unused Technology	Sources of the problems & challenges (Information and ICT)
problems are avoidable **accountability** **responsible for these problems and challenges** **having exhaustive information**	Problems have solution Accountability Responsible bodies Comprehensive information State of the art technology Communication and	Information ICT Responsible bodies	Holistic strategy (as a solution)

stat of the art technology **communication medium** **information exchange medium** **regional admin** **federal gov't coordination** **full-blown information** **gather and store all the information integrated way** **holistic solution needed**	information exchange medium Holistic course of actions		

ANNEX H: IS Strategy Evaluation Survey Questionnaire

Addis Ababa University
College of Natural Science
Department of Information Science

Dear Sir or Madam:

In partial fulfillment of the requirements for the Degree of Master of Science in Information Science, I am undertaking a research on "Problems and Challenges on Addis Ababa Land and Infrastructure Management: Towards an Information System Strategy" at Addis Ababa University. Based on the focus group discussion held on before, I have proposed an IS Strategy and accordingly prepared this survey questionnaire. The objective of the survey is to evaluate the proposed IS Strategy with respect to its comprehensiveness, clarity, completeness, correctness, and applicability.

This research is believed to produce results that can improve the Land and Infrastructure Management of Addis Ababa.

Thank you for your dedication to provide your genuine feedback regarding the proposed IS Strategy.

Thank you again!

Fasil Bekele

General

1. The proposed IS Strategy is comprehensive in terms of coverage

○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

2. The organization and presentation of the IS Strategy is suitable.

○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

3. The objective of the IS strategy is comprehensible.

○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

Regarding the content of the IS Strategy

4. The content of the proposed IS Strategy is clear.

○ Strongly Disagree ○ Disagree ○ Neutral ◉ Agree ○ Strongly Agree

5. The content of the proposed IS Strategy is correct.

○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

6. The content of the proposed IS Strategy is complete.

○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

Regarding utility and applicability of the IS Strategy

7. The proposed IS Strategy is applicable.

○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

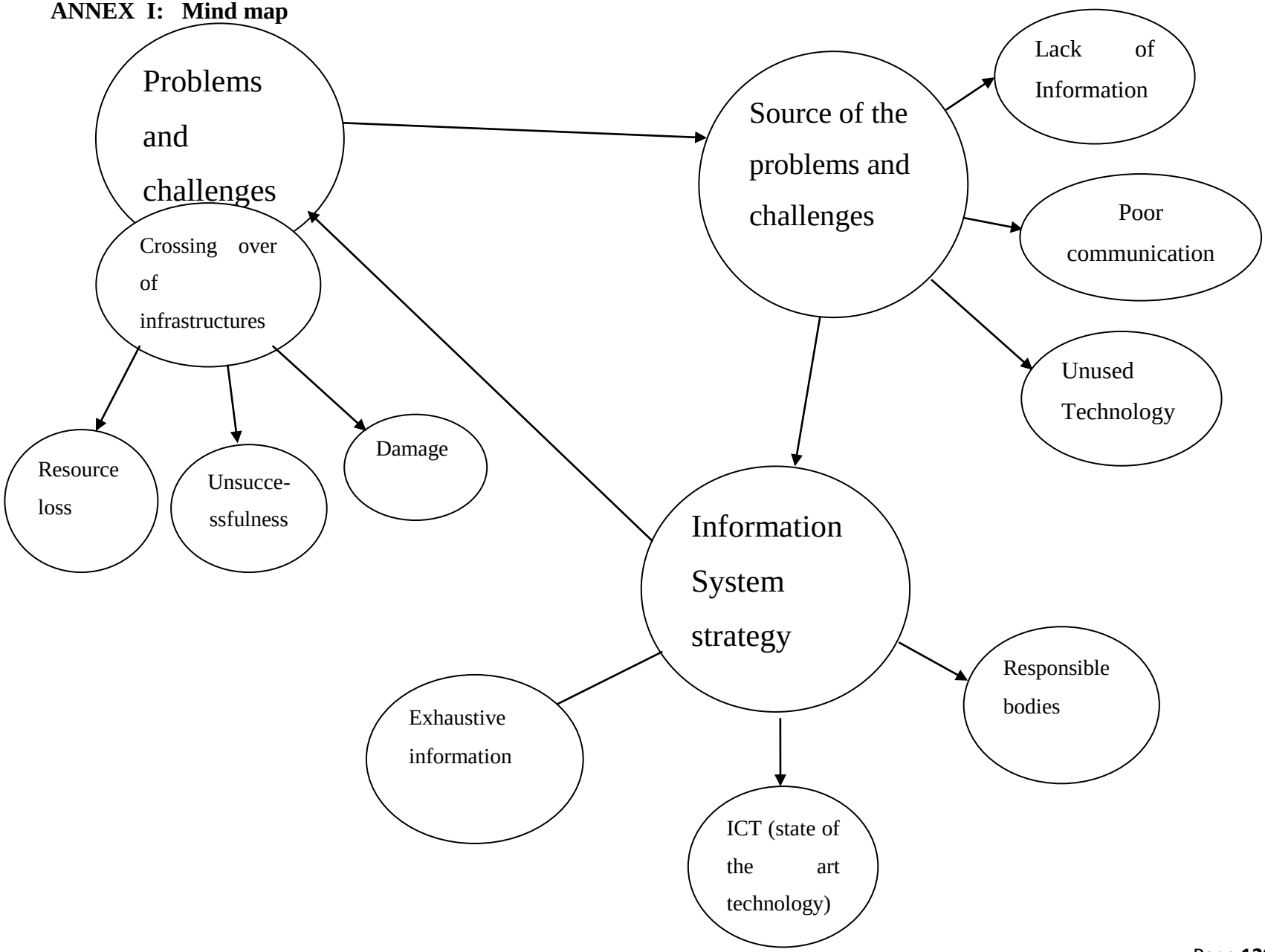
8. The proposed IS Strategy is in line with the policies and strategies of the stakeholder organizations.

○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

9. The implementation of the proposed IS Strategy can improve the Land and Infrastructure Management of Addis Ababa.

○ Strongly Disagree ○ Disagree ○ Neutral ○ Agree ○ Strongly Agree

ANNEX I: Mind map



DECLARATION

I declare that the thesis is my original work and has not been presented for a degree in any other university.

_____

Date

This thesis has been submitted for examination with my approval as university advisor.

_____

Advisor