E-GOVERNMENT BASED LAND INFORMATION SYSTEM ARCHITECTURE: A CASE OF NEPAL

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Enschede, the Netherlands,
February, 2012

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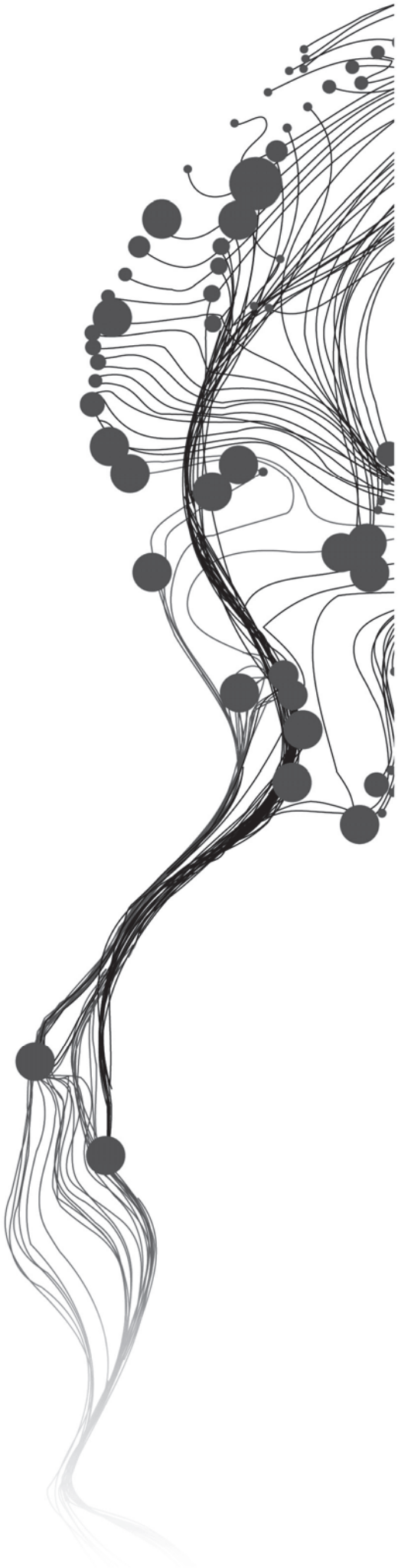

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Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-Information Science and Earth observation.
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ABSTRACT

Government organizations use Information and Communication Technology to increase efficiency and effectiveness in the service delivery. e-Government can bring improvement in efficiency, easy availability and accessibility of service and information to the citizens, business organization, professional users as well as government organizations. The main aim of this research is to propose business architecture for Land Information System (LIS) integrated in an e-Government environment.

Using "Technology Enactment Framework" as starting point in this research, the literature reviews firstly indicate a list of factors causing failure of e-Government systems particularly in leadership failure, political influence, financial inhibition, digital divide, poor coordination, poor technical design, lack of necessary infrastructure and insufficient experienced IT human resources. Investigation using literature also shows that policy and regulations, citizen centric approach, technology and infrastructure, actors, data and information, security and quality are dominant elements for e-Government environment. Considering those identified factors and elements, unstructured questions relating technology, organization structure and institutional arrangement were designed for interviewing different categories of actors in Nepal for designing LIS business architecture in the context of e-Government. Analysis identifies sixteen user requirements. Policy, rules and regulations for electronic services, directives for electronic transaction, e-payment, e-conveyancing and assigning key registers are essentially the institutional aspects, while organizational requirements includes integration of land administration organizations, integration of government data into GIDC, provision of sufficient IT manpower, IT service management and coordination and flexibility of the organizations. Finally, technical requirements includes system adherence to NeGIF and GEA, provision of web-based system, provision of e-payment, use of NID, integration of LIS (spatial and attribute), data quality and security and availability of internet.

Further analyzing these requirements bring a business architectures supported by the related information and system architecture as outcomes of enacted technologies. Business architecture shows the primary and secondary services provided by the land administration organizations and the security system to access these services through different customer service system like counter, mobile, phone, e-mail and the web portal. Primary services are those provided by the land administration organizations like ownership transfer, parcel sub-division, mortgage registration etcetera. Secondary services are the one necessary to support primary service and provided in coordination with other organization like, bank, municipality, district administration offices and deed writers. Thus, the architecture shows all the three models of e-Government i.e. G2G, G2B and G2C. Further, information architecture shows the access of users to the key registers through enterprise service bus and the management of their rights. System architecture shows the location and connectivity of the client and server on the basis of three tier client server concept.

Although the study of Dutch cadastral system provides further in-depth knowledge in the design of architecture, business architecture is tested by business workflow and discussion as a part of validation with a Cadastral Expert of Netherlands Kadaster office suggesting for conducting a risk analysis. The risk analysis identifies nineteen probable risks including reluctant government, passive leadership, and insufficient legal framework etcetera. Good governance of service delivery with attention to areas as finance, capacity, IT service, security; service support (service desk); ICT infrastructure management; application management are most important for the successful implementation of the system.

Key words: e-Government, Land Information System, Architecture, Technology Enactment Framework, Nepal

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Susheel Dangol

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LIST OF ABBREVIATIONS AND ACCRONYMS

ADB : Asian Development Bank
ADSL : Asymmetric Digital Subscriber Line
AGAF : Australian Government e-Authentication Framework
API : Application Programming Interface
CDMA : Code-Division Multiple Access
CIO : Chief Information Officer
DAO : District Administration Office
DLIS : District Land Information System
DLRO : District Land Revenue Office
DoDAF : Department of Defense Architecture Framework
DOLIA : Department of Land Information and Archives
DOLRM : Department of Land Reform and Management
DSO : District Survey Office
EC/EU : European Commission/European Union
EMV : Europay, MasterCard and Visa
ETA : Electronic Transaction Act
ETR : Electronic Transaction Rules
EULIS : European Land Information Service
FIG : International Federation of Surveyors
G2B : Government to Business
G2C : Government to Citizen
G2G : Government to Government
GAM : e-Government Adoption Model
GEA : Government Enterprise Architecture
GIDC : Government Integrated Data Center
GIS : Geographical Information System
GML : Geography Markup Language
GoN : Government of Nepal
HLCIT : High Level Commission for Information Technology
HRD : Human Resource Development
HTML : Hyper Text Markup Language
IBM : International Business Machine
IC : Integrated Circuit
ICT : Information and Communication Technology
IDMS : Integrated Database Management System
INSPIRE : Infrastructure for Spatial Information in the European Community
IOIS : Inter Organizational Information System
IS : Information System
ISO/IEC : International Organization for Standardization/International Electro-technical Commission
IT : Information Technology
ITIL : Information Technology Infrastructure Library
JDBC : Java Database Connectivity
KIPA : Korean IT Industry Promotion Agency
KLIS : Korean Land Information System
KML : Keyhole Markup Language
KU : Kathmandu University
LADM : Land Administration Domain Model
LIS : Land Information System

MD : Million Dollars
MOD : Ministry of Defense
MOGA : Ministry of General Administration
MOLJ : Ministry of Law and Justice
MOLRM : Ministry of Land Reform and Management
MOTM : Ministry of Transportation Management
MS : Microsoft
NeGIF : Nepal e-Government Interoperability Framework
NID : National Identification
NITC : National Information Technology Center
NTA : National Telecommunication Authority
OCR : Optical Character Recognition
ODBC : Open Database Connectivity
OECD : Organization for Economic Co-operation and Development
OOSDM : Object Oriented System Development Methodology
OGC : Open Geospatial Consortium
OPMCM : Office of Prime Minister and Council of Ministers
PCI : Payment Card Industry
PEOU : Perceived Ease of Use
PIN : Personal Identification Number
PSC : Public Service Commission
PKI : Public Key Infrastructure
PSI : Public Sector Information
PU : Perceived Usefulness
RAD : Rapid Application Development
RM-ODP: Reference Model of Open Distributed Processing
SDI : Spatial Data Infrastructure
SMS : Short Message Service
SSA : Soft System Analysis
SSDM : Structured System Development Methodology
STRADIS: Structured Analysis, Design and Implementation of Information System
SII : Spatial Information Infrastructure
SOA : Service Oriented Architecture
SQL : Structured Query Language
SSL : Secured Socket Layer
TAFIM : Technical Architecture Framework for Information Management
TEAF : Treasury Enterprise Architecture Framework
TEF : Technology Enactment Framework
TOGAF : The Open Group Architecture Framework
UML : Unified Modeling Language
UN : United Nations
VDC : Village Development Committee
VPN : Virtual Private Network
WFS : Web Feature Service
WML : Web Markup Language
WMS : Web Map Service
WWW : World Wide Web
XHTML : eXtensible Hyper Text Markup Language
XML : Extensible Markup Language

1. INTRODUCTION

This chapter gives the overview of the research. It briefly discusses the research problems, objectives and research questions to get answers for fulfilling the research objective. The conceptual framework, research methodology and data collection methodology are also discussed briefly in this chapter. Finally, a summary of the chapters of the thesis is discussed at the end of this chapter.

1.1. General background

"e-Government is the utilization of electronic technology to streamline or improve the business of government" (Godse & Garg, 2007). It is the relation between government, customers and suppliers through electronic means. Zarei and Ghapanchi (2008) stated e-Government as the Information and Communication Technology (ICT) used to modify procedures of government agencies. It redefines the role, responsibility and business process of the government organization using modern ICT (Navarra, 2010). Development of e-Government is directly linked to Information Technology (IT) which is capable to support the e-Government (Basu, 2004).

Basu (2004) considers that the inadequacy of legal framework may be one of the risk factors in implementing e-Government, and its success depends on the provision of a proper and adequate legal framework by the government. Since the technology is developing faster, the legislation that will be developed should be technologically neutral with flexibility of changing within the framework (OECD, 2003). Aldrich *et al.* (2002) also address the necessity of understanding policy environment that affect e-Government deployment.

Use of e-Government concepts is increasing in the government organizations around the world since its introduction in the early 90's (Ahn & Bretschneider, 2011). Use of new technology in the government organizations to increase the efficiency and effectiveness in service delivery has now become the "e-Government hype" (Meijer *et al.*, 2009): without any preparation of the system and necessary infrastructure, organizations try to transform the service delivery system. Like two parts of a coin, e-Government also has positive and negative aspects. Ke and Wei (2004) found that improvement in efficiency, availability, accessibility of services and provision of information to the citizens as positive output of e-Government. It supports in modernization of public administration for effective and efficient service delivery and plays a vital role in controlling corruption by reducing exaggeration and frauds in paper work (Bhuiyan, 2011). Andersen (2009) shows that e-Government is a practical means to reduce corruption significantly by providing transparent workflow, eliminating arbitrary task and controlling bribes. It also helps in transferring bureaucracy from authoritative to citizen centric cultures (Ahn & Bretschneider, 2011). On the other hand, there was disappointment in citizens as the organizations cannot reach the promise of transforming the service delivery and improving public trust in government (West, 2004).

However, success or failure of e-Government implementation depends on various factors. Boersma *et al.* (2009) discussed four factors of failure of e-Government implementation as inappropriate use of new technology; lack of re-design of systems according to the technology; political and legal constraints and the attitude of people in coping with old technology. Along with lack of user involvement, inadequate dedication and improper planning, rituals endorsed by the management are the major causes of failure of a financial management system development project in India (De' & Sarkar, 2010). Strong leadership with vision of successful implementation of e-Government and strong political will, development of information infrastructure, bridging digital divide, appropriate legal framework, sufficient budget and availability of skilled human resources are the major factors of successful e-Government (Ke & Wei, 2004; Yoon & Chae, 2009). In case of Nepal as well, lack of technical infrastructure, human resources, coordination, stable government, system design, awareness and motivation are the major problems in implementing e-Government (Kharel & Shakya, 2011). Akther *et al.* (2007) focus on the citizens' participation as the driving factor for successful implementation of e-Government and thus states that if the necessities of the citizens are properly addressed, e-Government projects can be successfully implemented with appropriate technological tools. Al Nagi and Hamdan (2009) also say that correct

identification of the e-service necessary for the citizen is one of the major factors for successful implementation of e-Government.

In line with above stated factors, seven barriers to the e-Government implementation are identified by the European Commission sponsored study as: leadership failures, financial inhibitors, digital divides, poor coordination, organizational inflexibility, lack of trust, and poor technical design where the last point refers to user interface design rather than software design (EC, 2007). Lack of adequate leadership during initiation, implementation, promotion and on-going support of developments is considered as leadership failure; inappropriate cost benefit analysis inhibiting the flow of investment is stated as financial inhibitors; inequalities in skill and access to ICT is defined as digital divide and lack of coordination and harmonization among inter organization is taken as poor coordination. Similarly, inflexibility in change in public administration practices, processes and organizational structures is considered as organizational inflexibility; fears about security and privacy is stated as lack of trust and incompatibilities in user interface design is taken as poor technical design. In spite of these barriers, e-Government policy visualize the use of ICT to gain efficiency and cost savings in public sector (Bekkers & Homburg, 2007).

Karim *et al.* (2010) says that e-land administration brings about simple and efficient service delivery, data sharing and system integration. Netherlands is one of the member countries of EC whose LIS is understood as one of the best system. Declaration of cadastral information of Dutch cadastre as key register or the authentic information to be used by public agency (Zevenbergen *et al.*, 2009) proves as an example of successful ICT implementation in land administration. Online provision of information to the customers has helped in supporting easy access to the cadastral information and even to the electronic conveyancing. LIS in the Canadian province of New Brunswick increased efficiency of land transactions and registrations resulting in time lag of minutes instead of days between the completion of processing the transaction and availability of updated information (Ogilvie & Mulhollnad, 2004). The *Bhoomi* project in India is good example of LIS which helped in easy access to information to the farmers and reduction in corruption by controlling the need of bribe for the task (Thomas, 2009). Citizens can easily get the required information from the kiosks situated in the sub districts with finger print authentication. In Singapore, migration of a traditional paper based system to a computer based system helped in providing citizens with the fast and convenient government services and the citizens who don't have access to the internet were provided services through the community based terminals (Ke & Wei, 2004).

However, goal and aim of e-Government policy can be achieved by overcoming the complexities associated with ICT developments for public sector during e-Government implementation (Cordella & Iannacci, 2010). The use of ICT in land administration brings about efficient and effective service delivery, customer satisfaction and reduction in operating costs (Kalantari *et al.*, 2005). Likewise, successful land information system should provide the necessary information to support efficient and effective land administration services and are guided by the government policy. LIS can integrate different tasks in traditional cadastres and land registration system into one thus increasing the efficiency in land administration services (Tuladhar, 2003). Thus, support from ICT is essential to achieve the objectives of the land administration organizations (Molen & Lemmen, 2003).

Whatsoever, focusing on the minimization of the above stated barriers; an appropriate design of the information system architecture is a must for the successful implementation of e-Government. ISO/IEC 42010 (2007) define architecture as "the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution". The Open Group (2009) simplifies the definition as the "formal description of a system, or a detailed plan of the system at component level to guide its implementation" and are represented by different views. Four different types of views are defined by the open group architecture framework. *Business architecture view* concerns about the functional part of the system from the user perspective. *Data and application architecture view* deals about software, data computing components, communications, security etc. from database designer and administrator perspective. Finally, *technology architecture view* deals with different paths of communication with a concept of a network from operators, communication engineer, administrator and mangers perspective. Further, Morales and Vissers (2004) distinguished components of architecture in terms of three simplified elements as *data element, processing element and connecting elements.* Food and Agriculture Organization of United Nations (FAO) have designed Solution for Land Administration (SOLA) architecture in three layers as *presentation, service and data layer (FAO, 2011a).* Also, a concept of Service Oriented Architecture (SOA) has been developed to provide service to the client and develop

architecture based on the service (The Open Group, 2007). However, the development of appropriate architecture will support in minimising one of the barriers of e-Government – that is poor technical design.

LIS of Austrian land administration system have clearly defined the technology architecture, data architecture and application architecture (Hoffmann, 2003). In case of the Italian LIS, the application architecture and the technology architecture are well defined where application architecture even tries to link up with G2G and G2B model of e-Government (Selleri & Fabrizi, 2003). Similarly, in the Czech Republic there is a application and technology (network) architecture (Suchanek & Jirman, 2003). The Dutch cadastre has an architecture definition with concept of G2G, G2B and G2C model of e-Government. Application of SOA in Egypt for G2G model has given successful output in providing satisfaction to citizens, improvement in process time and efficiency in government staff (Klischewski, 2011).

1.2. Research problem

Karim*, et al.* (2010) state that the implementation of e-land administration might be difficult if it is incompatible with legal framework and thus may need to adjust either in the existing system or the legal framework. Meneklis and Douligeris (2010) have given guidelines for the development of information systems supporting e-Government which include a precise boundary of definition of enterprise services (business process of organization) and electronic services (functions of information system), interactions between information system and its environment (historical, economical and political background), technical specifications and a series of iterations in development of system and the results. Brancheau *et al.* (1989) identified business functions, existing applications and organization structure as the basic input necessary for the development of information architecture. Bernus and Schmidt (2006) state that, information systems are integrated with the organization and the organization needs to describe how the information system is used by organization in terms of collecting, processing, storing, retrieving and disseminating the information. Research by Cordella and Iannacci (2010) shows that choice and design of technology is derived from e-Government policy and the organization structure.

However, architectures described in different countries taken as example focus on *application, data and technology architecture*. They also do not trace the models (G2G, G2B and G2C) of e-Government clearly with some exceptions. This brings about the necessity of clear definition of business architecture based on e-Government which is one of the views of architecture as defined earlier. This thesis focuses in designing e-Government based *business architecture* for LIS.

1.3. Motivation

Good technical design considered as one of the barriers of e-Government can be achieved by appropriate development of information system architectures. Regarding the information system architecture, all views of the architecture need to be clearly defined. In the case of Nepal the business architecture still has to be defined and designed. In the case of Nepal as well, the data architecture is only defined a bit clearly but all other three views (business, application and technical) are not well defined. Focusing in this thesis is design of the business architecture for a land information system with Nepal as a case.

1.4. Research objectives

1.4.1. Main objective

To design a business architecture for a land information system based on e-Government with focus to Nepal.

1.4.2. Sub objectives

- To minimize the discrepancies between e-Government policy and land information system.
- To design a business architecture and related information and system architecture.

1.5. Research questions

The questions concerned to sub objective are as follows:

Sub-objective 1

1. What are the land-information related elements required in LIS according to user's requirement?
2. What are the land-information related elements in e-Government policy?
3. How to align elements of LIS into e-Government policy?

Sub-objective 2

4. What are the requirements of LIS in terms of institutional, organizational and technological aspects?
5. How to design LIS business architecture?
6. How to validate designed architecture?

1.6. Conceptual framework

The overview of the conceptual framework for conducting this research is given in figure 1.1. This conceptual framework maps all the elements related to the research. Land-Information related elements could be organizational, institutional or technological. Together with these elements, available technology and user's requirement, the business architecture for LIS can be designed for computer based service delivery. The technology enactment framework (section 1.7.1) gives the information about available technology, organizational and institutional setup and actors involved, which gives the information about the perceived technology or the enacted technology in the terms of the framework.

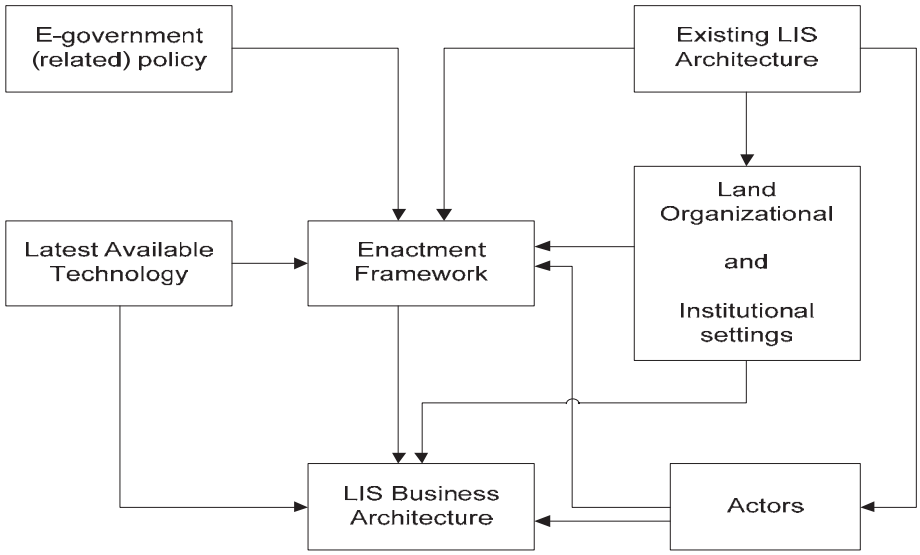

Figure 1-1: Conceptual framework.

1.7. Methodology

The following sub-sections explain the methodology adopted for this research.

1.7.1. Research method

For this research, the case study method together with desk research and the Technology Enactment Framework (TEF) has been used.

a) Case study research

Case study research is used for testing or building theory, with a single or multiple study design, using qualitative or mixed methods and thus making it highly useful research strategy for IS (Cavaye, 1996).

Qualitative research is very relevant in the field of Information System (IS) to understand the users (Trauth, 2001). The thesis is qualitative type of research. For this thesis single case is taken that of Nepal since the country resembles problems of most of the developing countries.

b) Desk research

Desk research is totally based on literature review. This method is adopted to get information on policy issues in e-Government and problems and issues in existing land information system architectures.

c) Technology enactment framework

Technology Enactment Framework (TEF) discusses about the use of ICT in public administration from institutional perspective on the basis of available technology (Fountain, 2001). It gives a clear idea about the available ICT and the used or perceived ICT. Role of different actors have been included in the revised TEF (Schellong, 2007). The revised TEF has been used to identify the actors or users for this thesis. The TEF is followed with the design methodology as well. Details are discussed in the chapter three.

1.7.2. Research design

Research design is the procedural plan which is followed by the researcher to get the solutions to the questions and the problems (Kumar, 2005). Table 1.1 gives detail overview of research design.

- To answer question 1 and 2, desk study on the existing relevant policy, act and rules has been done. Documents like e-Government master plan, electronic transaction rules and electronic transaction act has been reviewed. The source of information on success and failure factor for e-Government implementation was retrieved from journals, papers and reports which are discussed in chapter two in detail. Regarding the recent developments or changes in the field of e-Government, key-informants were interviewed. The respondents were government officials like secretary and joint secretary of the ministries and director generals of the department, staff of banks, municipality and deed writers.
- To answer question 3, information from question 1 and 2 is used.
- Data has been collected from the interview with the high level as well as operation level staff in the department and district offices. Observation of the existing architecture was done during field visit. This will give the answer for question 4 which is discussed in detail in chapter four.
- Data collected from question 4, results from question 3 and literatures has been used to answer question5 as discussed in chapter five.
- The designed architecture has been validated by the Land Information experts.

Table 1.1: Detail of research design.

Research Objective		Research question	Data Source	
Main	**Sub**		**Primary**	**Secondary**
To design business architecture for land information system based on e-Government with focus to Nepal	1. To minimize the discrepancies between e-Government policy and land information system	1. What is the land information related elements required in LIS according to user's requirements?	Interview	Software document
		2. What are the land-information related elements in e-Government policy?	Interview	Government documents, existing laws and policy
		3. How to align elements of LIS into e-Government policy?		Literature
	2. To design business architecture and related information and system architecture	4. What are the requirements of LIS in terms of institutional, organizational and technological aspects?	Interview	Literature
		5. How to design LIS business architecture?	Interview	Literature
		6. How to validate designed architecture?		

The research has been conducted under three phases as pre-field, field and post field phase.

Pre-Field Work: On the basis of literature review, land information related issues incorporated in e-Government (related) policy have been reviewed. Then after, necessary preparation for the field work in Nepal was done, which included design of questionnaire, preparation of field work schedule and identifying the key informants.

Field Work: This part of the research phase has been devoted in collection of primary and secondary data in the study site.

- Interviews and observations method was followed to collect primary data.
- Secondary data was collected from the relevant document on land information system.

Post Field Work: After the completion of the field work, analysis was done to find the discrepancy between existing policies and the land information system. And on the basis of that, business architecture for Land Information System was designed. The phase was finished after completion of the report. Figure 1.2 gives detail overview of the research methodology.

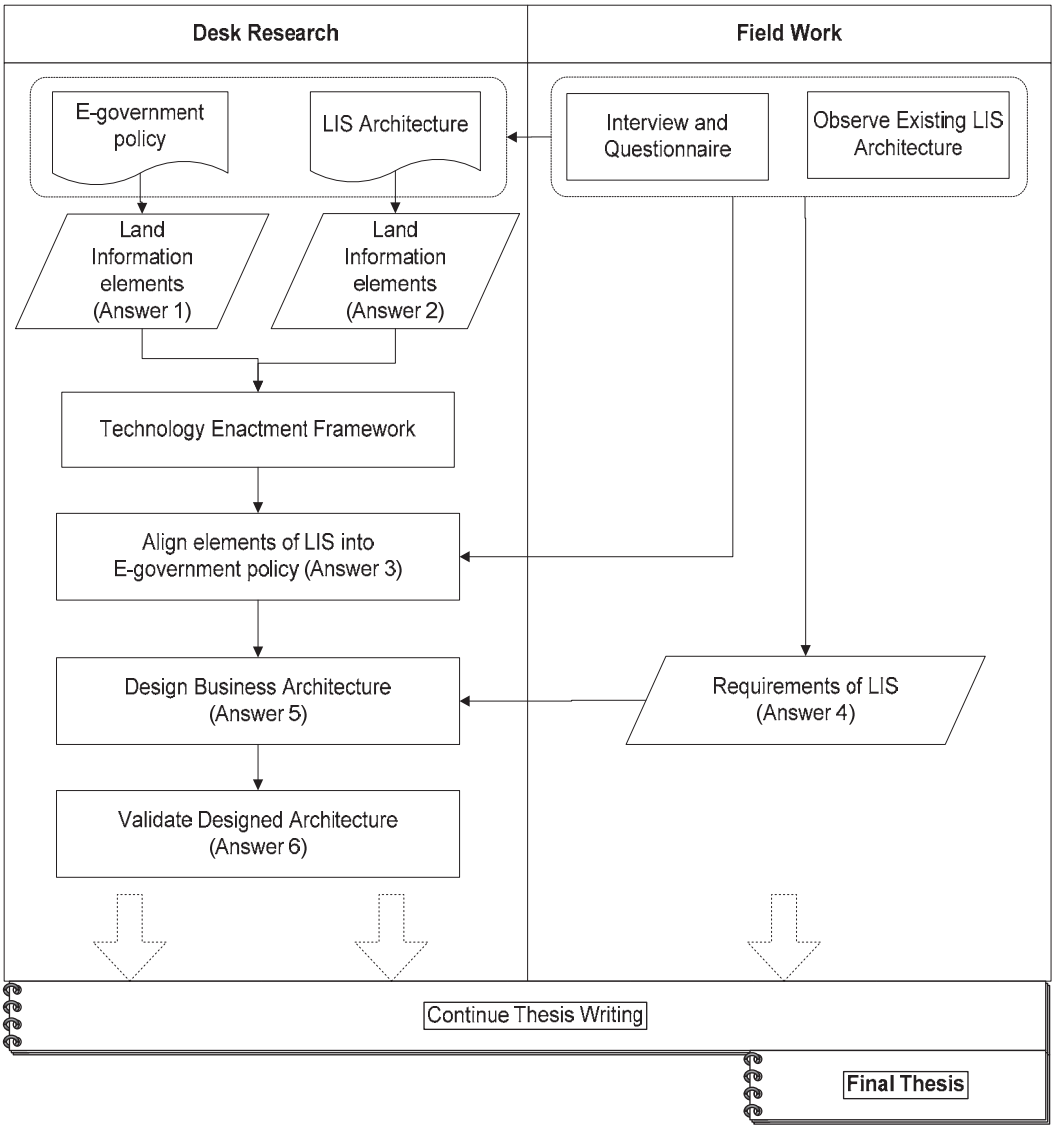

Figure 1-2: Research methodology.

1.7.3. Data collection

Both the primary and secondary source of data has been used for this research. For the primary data, interview was used. Interview has been used for the policy level staff because it gives flexibility in formulating questions if necessary and can collect detailed information and the question can also be clarified (Kumar, 2005). The written list of unstructured questions has been used for this method to get uniform information. Different government reports, policy documents and software documents have been collected from the respective organizations.

1.8. Resources used

Hardware

- Digital camera for photographs
- Computer PC and laptop
- Voice recorder for recording the interviews

Software

- ArcGIS for study area visualization
- Microsoft office (Word, Excel, PowerPoint, etc) for managing interview data, report and thesis writing, etc.
- Microsoft Visio with UML for designing architecture

1.9. Thesis structure

The final thesis report has been presented in seven chapters. The contents of the chapters is briefly discussed below

Chapter 1: Introduction
This chapter provides the overall view of the research. Background, research problems, objectives and sub-objectives is discussed. Then, several research questions follow the objectives. Further, the chapter also discusses about the conceptual framework and research methodology.

Chapter 2: e-Government and land information system: A review
This chapter is focusing on literatures in the issues and trends in e-Government and its relation with Land Information System. Developments in e-Government policies, its influences on LIS are discussed. Success and failure cases on implementing e-Government and LIS were reviewed.

Chapter 3: Research methodology
The chapter discusses on how the whole research was conducted within the assigned time period. The chapter describes about the methodology that has been followed along with the research design for identifying the potential key respondents and the methodology to design the architecture. Further, this chapter discusses about methodology of data collection during the field study, whose analysis has been done in successive chapters. This will also talk about the designing interview questions and preparation for field visit.

Chapter 4: Data analysis and results
The data collected from the field work are analyzed and expressed in this chapter. The results obtained from the data analysis were further used for designing architecture in further chapter. Then after on the basis of the analysis and results, the chapter also discusses about the requirements and the specification which has been followed for designing architecture.

Chapter 5: Designing LIS architecture
This chapter gives the business architecture, information and system architecture which is one of the objectives of this research. It is based on the methodology described and the results from the previous chapter and literature review.

Chapter 6: Risk analysis and plan of implementation
This chapter discusses about the risk in implementation of e-Government system. Similarly, it also talks about the indicative implementation plan of the system.

Chapter 7: Conclusion and recommendation
This chapter gives the concluding remark of the whole research along with some recommendations.

2. E-GOVERNMENT AND LAND INFORMATION SYSTEM: A REVIEW

2.1. Introduction

Different literatures regarding e-Government, LIS and system architectures are discussed in this chapter. The chapter is divided into four further sections. Section 2.2 discusses about the stories of e-Government, its models and success and failure cases. In section 2.3, the concept of LIS is discussed. Section 2.4 provides the introduction about the architecture and tries to link with e-Government and LIS. Finally, in section 2.5, necessity of architecture has been discussed. This chapter gives the answer to the first and second research questions.

2.2. e-Government issues and trends

The World Bank defines e-Government as the use of information technology by government organizations so that the technology helps in reducing corruption by providing transparent workflows, providing convenient and cost effective business and increasing revenues (The World Bank, 2011). "e-Government in its most generic form refers to the automation of government processes and services by using modern information and communication technologies, usually – but not necessarily – in combination with web technology" (Rombach & Steffens, 2009). e-Government also supports in coordinating and co-working with different government agencies easily. It also helps in bridging the gap between citizens and the government organizations through the means of ICT.

Layne and Lee (2001) have developed a model which defines four stages of e-Government development processes. The development starts with a simple and limited facility to a very complex, integrated, networked and completed system.

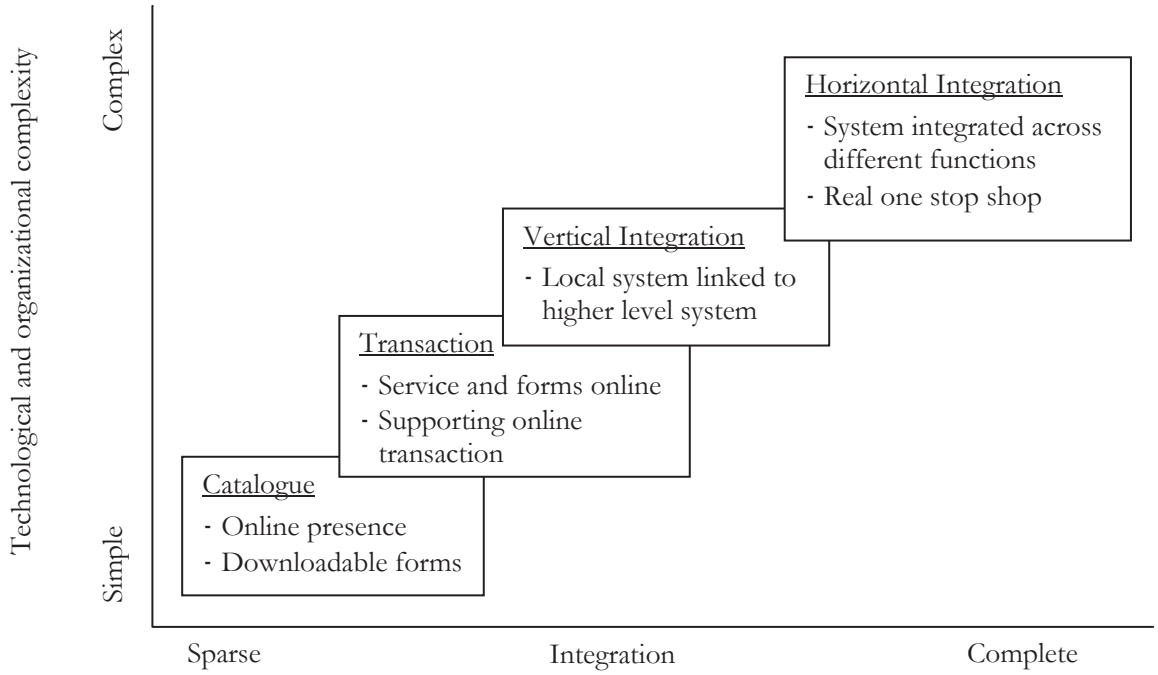

Figure 2-1: Stages of e-Government development. (Layne and Lee, 2001)

Availability of government information necessary for the customers through the websites and downloadable forms is the first stage of e-Government according to Layne and Lee (2001). People can get required information from the government agency through their websites. In the second stage, online transactions are also provided by the organizations. The third stage is the integration of all the local offices

with the central office. The horizontal integration of the development stage means the integration or link with other organizations as well. The Dutch e-Government system can be taken as the example for this stage. Different government databases can be linked with each other on the basis of the system of key registers. Different sectors like compatibility, interoperability, security need to be clearly maintained to reach fourth stage because of which the writers even define this stage as a very complex one.

Still, the system should adhere with the factors defined by e-Government Adoption Model (GAM) for its adoption by the citizens (Shareef *et al.*, 2011). This model says that attitude, ability, assurance, adherence and adaptability are the factors determining the adoption of e-Government by the citizens. If the person gets the perception of the usefulness of the system and easiness to use then it brings a positive attitude towards using the system. They also should be assured about the quality and security of information and the services. If the citizen gets a perception on the benefits from the function of e-Government and can visualize how to use the system then it gives positive attitude to adhere and adapt the system. Though Shareef*, et al.* (2011) says that the factors only imply to the citizens, it also implies to the organizations as well regarding the people working in the organizations. If the staffs don't have the attitude of adopting and don't have the ability to use the system e-Government won't get success. Because they are also the one who use the system and who give service to the citizens using the same system.

2.2.1. Issues and applications

Different issues come forward in successful implementation of e-Government. Before developing and implementing any system those issues need to be clearly addressed.

a. Policy and regulations

e-Government policy is the basic legal document for the implementation of e-Government. The e-Government action plan of the EU also emphasizes on the combination of new technologies, innovative architectures and the availability and re-use of Public Sector Information (PSI) with less financial resources (EC, 2010a). INSPIRE directive[1] is the common legal document of European Union for information sharing, interoperability heading to Spatial Data Infrastructure (SDI) which finally support for cross border e-Government. Different countries implement e-Government on the basis of policy or act and rules. The Austrian government prepared a e-Government strategy in cooperation with government and private organizations and turned it to a e-Government law, which provides the option to the citizens to choose electronic or paper based service (UN, 2005). To implement e-Government, Bangladesh government introduced ICT policy 2009 to establish a transparent, responsive and accountable government, develop skilled human resource, enhance social equity and cost effective delivery of service to citizens (Bhuiyan, 2011).

The e-Government act in the USA was formulated in 2002 to establish guidelines to deliver information through the World Wide Web (WWW). The goal was to increase opportunities for citizens-participation in government, citizen centered government information and services and access to high quality government information and service (Paul, 2004). Research by Cordella and Iannacci (2010) shows a direct link between the technology behind the e-Government system and the e-Government policy and says that e-Government policy supports in inter agency collaboration. Some of the countries even developed an e-Government strategy. For example, Stockholm, the biggest municipality in Sweden prepared a e-strategy to consolidate the IT infrastructure, multichannel delivery of service to citizens, integrated service to citizens, multi sector interoperability and IT in schools, education, culture, library, traffic and other services (Bermudez, 2007).

b. Citizen centric system

For e-Government, a citizen centric system is the major issue that is to be clearly understood. e-Government systems even may fail if the system does not address the requirements of the people like transparent and quick service, easy access to service and information. The *Bhoomi* system was developed totally for the farmers in Karnataka who need to find a village accountant, set up an appointment, make the request and pay the fees along with bribes to get the required documents which still needs to wait for a number of days (De' & Sen, 2004). Now they can go to the closest kiosk, submit the necessary information and receive the required documents within 15 minutes. Information about legal rights,

1 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:EN:PDF

taxation and charges on land, shape, size and land use are kept and people can obtain copies and correct errors of those land records through the kiosk from 177 district branch offices (Chawla & Bhatnagar, 2004; De' & Sen, 2004; IRMT, 2007). The databases are stored in individual offices and are planned to be uploaded to a central database in Bangalore. Transactions are already done but still not integrated with each other. This shows that the system is in the second stage of e-Government development. However, citizens also should be aware about the facilities and are provided with the access to the technologies. If the citizens don't know the availability of the facilities and don't have the access to the technology, then the system will have no use like for example for the remote areas. This brings up about the need of reducing the geographical digital divide between rural and urban area as well.

c. Technology and infrastructure:

Government need to have the necessary technologies adopted to provide the services considering the needs of citizens. Technology and IT infrastructures used to set up the e-Government system plays role in adoption of the system by the citizens: the user friendliness is meant here. If it is not user friendly then the users will not use the system. If the internet is very slow and citizens need to wait for a long time to get information then this obviously gives negative impact on the Perceived Usefulness (PU) and the Perceived Ease of Use (PEOU) and go for traditional system (Lin *et al.*, 2011). Total coverage of telecommunication lines, digital database of all public data and national spatial data were identified as the most essential technical issues in e-Government (Ossko, 2007).

e-Tanah, the web based LIS of Malaysia is a good example of technological development. Malaysia had different software for different applications in land administration. A computerized land registration system was developed to automate registration system, and a computerized land revenue system was developed to automate the collection process of land revenue and e-consent was to support the flow of applications and consents from different authority levels Those applications were not able to share common information for interrelated tasks thus producing redundancy in data and process along with number of other disadvantages. *e-Tanah* provides links and integration of all land administration processes (Karim*, et al.*, 2010).

Further detail, Ossko (2007) also addresses the necessity of including digital signature, e-document and e-conveyancing and necessary legal changes to include them to support e-Government. Obviously, e-Government does not mean only the government service delivery by computer but all other supporting processes should also in a computer based system. Ossko (2007) did not talk about an e-payment system which is another necessary process in e-Government.

A complete e-Government system should address all three models i.e. G2G, G2B and G2C models of e-Government. The Netherlands is a good example with a good set up of e-Government, where the e-Government architecture program was started in 2003 (Bayens, 2006). The land registry system in The Netherlands has started e-conveyancing, e-transaction along with e-payment where different banks are involved. Kadaster-on-line is the one which conducts all the electronic process related to land registry and won the e-Europe award for e-Government in 2005 (UNPAN, 2009). Thus a combination of technology along with user friendly interface and human resource is necessary for success of e-Government.

d. Actors

Lambrinoudakis *et al.* (2003) classified actors of e-Government systems. System administrator, service operator and customer were identified. Besides these, policy makers and other consultants are also the actors in e-Government systems. Actors play a crucial role in e-Government systems. Thapa (2011) studied the case of Nepal Wireless Networking Project to find the effect of actors in the effectiveness of the project. Teachers, social activists, health workers, students, local users and non-users of the ICT services were interviewed for the study. The research showed that a network of the individuals, organizations and technologies is necessary for successful completion of the process. Likewise, all the actors of the Hungarian land administration sector are connected through network which provides online access to information stored in the offices (Ivan *et al.*, 2010). Thus, this kind of infrastructure helps in easy access to information to the citizens (who are another actor of the e-Government system). Besides being citizen oriented, the government should also look for other ways which support, strengthen and develop government services reducing redundancy in data and services. Interoperability between different databases of different public organization should be maintained and the redundancy should be reduced.

Lacking of such consideration may produce stress in human resources in public organization (Goldfinch *et al.*, 2011) which may become the human cause of system failure.

e. Data and information

Available data and information is another issue in e-Government. Information sharing between the departments helps in managing resources, communicating essential information between concerned departments and thus decreasing redundancy and also efficiency in service delivery, whereas interoperability helps in reducing employees workload, expenses and errors (Hobson *et al.*, 2011). Hobson*, et al.* (2011) conducted a study of 12 government organizations from cities, towns, villages and county to find how service delivery is managed by the municipality and how the IT was used to support the service. The study showed that most of the IT applications are isolated and conduct the task only which is associated to a single department in spite of the tasks being related with work of other departments as well. When the person goes for a building permit in the building department, they also need to visit tax office for tax payments, and needed to be updated in finance department's general ledger. This shows that there exist complex interactions between the organizations, redundancy in data and job as well.

Assigning of authentic register is one way which helps in covering those kinds of situations as in the case of Netherlands. Once the data is assigned as a key register, other organizations are required to use those data as authentic data and are not allowed to produce those authentic data (e.g. names, addresses, parcels, buildings) themselves (Hein & Vries, 2003; Molen, 2005). The combination of key registers becomes a very strong information infrastructure where both spatial and non-spatial data are included. And the key registers that contain spatial data together contribute to SDI (Ellenkamp & Maessen, 2009). According to Ellenkamp and Maessen (2009), key registers are linked in two ways: administrative and geo referenced. Here administrative link is done by unique identifiers (parcels, addresses) and the link by geo referencing is done by using location on maps. If there is something changed in one register then it should be changed in all other related linked registers. So, the people don't have to give the same information multiple of times to different government organizations. This is in the same principle of data and information sharing and linking. Thus the concept of key registers helps in reduction of administration burden to citizens, companies, efficiency in government services, decrease in fraud, more transparent and legal government operation (Molen, 2005).

f. Security

Security is one of the most important issues in e-Government. The level of need of security increases as the number of e-Government services increases (Wang, 2009). Technologies like cryptography, PKI, firewall, digital signature are used for security purposes. Lambrinoudakis*, et al.* (2003) says that use of PKI can fulfill most of the security requirement in e-Government system. Authors studied for the EU funded project called '*Webocrat*' and designed an architecture of PKI based security which covered the necessities of security like registration, authentication, audit, directory service, digital signature, encryption, interoperability etcetera (Lambrinoudakis*, et al.*, 2003). Zhao and Zhao (2010) analyzed 50 e-Government sites of USA and found that username and password authentication, SSL encryption, internet traffic monitoring, intrusion detection, investigation of improper activities and proper use of anti-hacking statements are the key security measures. Hacking of government sites secured by DigiNotar in July 19, 2011 shows that security is the most essential and challenging issue in e-Government which affects the trust and confidence of citizens.

g. Quality

Quality of the system determines its sustainability. If the e-Government system have low quality then the users does not accept. Papadomichelaki *et al.* (2006) have identified quality of e-Government in two approach as 'introvert' and 'extrovert' in the area of service, content, system and organization. Introvert is the quality within the organizations and the extrovert reflects the quality of service that the clients receive. High quality e-Government system should provide quick and correct access to service, interoperable, secured and privacy maintained, reliable and unique identity (Quirchmayr *et al.*, 2007). Quirchmayr*, et al.* (2007) even designed quality model of e-Government service on the basis of ISO/IEC 9126 (standard for evaluating software quality) identifying nineteen quality characteristics. These characters resembles with the seven dimensions for measuring e-Government service quality identified by Alanezi *et al.* (2010) which are website design, reliability, responsiveness, security/privacy, personalization, information, and ease of

use. Similarly, Papadomichelaki and Mentzas (2012) also identify reliability, trust (security/privacy), ease of use, content of information, functionality of system and citizen support as the characteristics of quality of e-Government.

h. Human resources

Along with the technology and other infrastructures, Zakareya and zahir (2005) address the need of sufficient resources, capable IT staff and proper management for the success of e-Government. Experienced and capable IT people are necessary to manage and run the system and resources are very necessary to maintain the sustainability of the system. However, only this is not sufficient but also other IT infrastructure and the human resource expert in IT.

2.2.2. e-Government failure and success cases

There are many failure and successful cases of e-Government systems in the world. According to Heeks (2008), 35% of e-Government projects in developing countries are estimated to be total failures; 50% are partial failures; and only some 15% are fully successful. e-Government system in Korea is the best in the world which is proved by the top ranking followed by Unites States of America in e-Government development index from the survey of UN (UN, 2010). Successful e-land administration in Malaysia shows that integration of isolated system and that of IT infrastructure and human resource are necessary for success (Karim*, et al.*, 2010). Research by Imran and Gregor (2010) showed that limited knowledge and ingrained attitudes are the main causes of lagging behind in e-Government. Though the research only focus on G2G, it implies to G2B and G2C as well. Citizens are not aware about the advantages of e-Government and totally depend on deed writers who consider use of traditional systems as unseen source of income. However, in the cases of e-Government system failure, analysis is necessary to find the cause if the failure is due in the system or due to the human kind.

Hossan *et al.* (2006) did a research in e-Government system named e-citizens service application system in Bangladesh to find out the success and failure factor of e-Government. The research showed that the political desire, vision and strategy, self interest, strong management, adequate technological infrastructures are the success factors of e-Government and lack of all those success factors is the failure factors. Heeks (2003) developed a model with the gap between current reality and the proposed design in terms of information, technology, process, objectives and values, skills and management systems. More the gap in these elements more is the susceptibility of failure. On the basis of this model, research by Junseok and Syamsuddin (2008) showed that the e-Government of South Sulawesi (Indonesia) was total failure. The research was focused on infrastructure, staff skills, e-Government developments and e-Government implementation. Incompatibility between hardware and software, considering only for business purpose rather than public service and thus not accepting by the users and lack of sufficient IT experts were the reason of total failure. One of the main actor i.e. government employee were not willing to adopt the system and also didn't know how to use the system.

e-Government developments in South Korea have improved efficiency and transparency of administrative work, communication with people and government and efficiency in information management thus ranked number one in e-Government survey of UN (MPAS & NIA, 2011). Some of the best e-Government systems of Korea are electronic procurement service, electronic customs clearance service, comprehensive tax service etcetera. These systems supported in improvement of efficiency and transparency in administration and information resources, citizen focused service and strengthens communication of people and government (MPAS & NIA, 2011). Another success story is the electronic birth registration system of Bangladesh. Birth Registration Information System registers births electronically, provides citizen identity and is linked to population database thus enabling it to share with other public agencies as well. Encouraging and motivated young staff, motivated senior staff and citizen participation were the critical success factor of this system (Ahmed, 2002). Computerizing the services of Ministry of Foreign Affairs of West Africa was totally failure (Oliver, 2002). The purpose was to computerize all internal service of the ministry creating intranet as well as web based service and thus shares the information between ministry and diplomatic missions abroad. But because of politicization (personalization of tendering), clashes with personal interest and limited infrastructure, the project completely failed. E-passport in Spain is an example of successful e-Government system. The passport contain chip at the back side of which contains biometric data of face of the passport holder. Personal data is also enclosed in the machine-readable Optical Character Recognition (OCR) text.

2.3. Land information system

Information System (IS) is the set of components to collect, analyze and disseminate information to the users. The term is discussed as the interaction between people, processes, data, and technology in general. Land Information System is the special type of IS, a system that capture, process, store, analyze, disseminate and share land information. "The International Federation of Surveyors (FIG) defined a land information system as a tool for legal, administrative and economic decision-making and an aid for planning and development. A land information system consists of a database containing spatially referenced land-related data for a defined area including procedures and techniques for the systematic collection, updating, processing and distribution of the data" (UN, 2005).

Cadastre or land parcel is the primary component of LIS (Dhal, 2002; Y. Zhao, 2010). LIS helps in quick, reliable and easy land transaction (one stop shop), supporting urban planning and infrastructure development, land reform, reduce land disputes and so on. Molen and Wubbe (2007) says that LIS with e-transaction and e-conveyancing is necessary for e-Government. Broadly, advantages of LIS can be discussed in terms of efficiency, effectiveness and competitive advantage. LIS reduces labor requirements, saves space for storing analog documents, automatic control processes helps in data sharing, with better quality services. LIS is the system in which land related information is collected, stored, referenced, processed and retrieved, components of which are the data, process, technology and human resource. It supports land administration like alienation, transfer, valuation, development and utilization of land and land tenure security by providing current and reliable information and services at lowest possible cost (Tuladhar, 2004). Figure 2.2 shows the concept of LIS and its components.

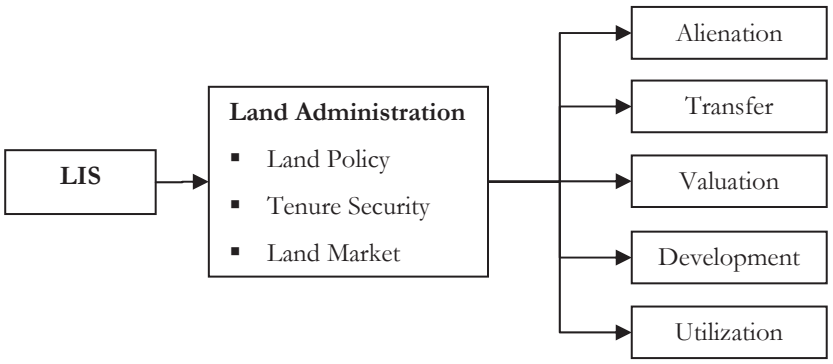

Figure 2-2: Land information system. (Tuladhar, 2004)

Citizen centred information system is the basic requirement in e-Government (Chen, 2010). Korean Land Information System (KLIS) is also an online application which provides electronic transaction service and necessary information through the kiosk (Kim *et al.*, 2008). KLIS consist of individual parcel map built by digitizing individual parcel from paper, continuous cadastral map by edge matching of individual parcel maps and edited cadastral maps built by transforming the continuous cadastral maps to overlay on topographic maps. The system is three tiered architecture with Oracle software as database platform. However, no description about key register is found in Korea. Korean government has established e-Government law in 2001 and e-Government roadmap in 2003 to support the e-Government systems in the country. KLIS is connected to cities, provinces and local government through national network and thus provides online services to the citizens also. Users can apply for the service through online system and receive the documents like land use certificate, land price certificate on the internet as soon as the application is made. They also have the call center to provide the information easily and quickly.

Landgate of Western Australia is the web based LIS to provide information about land and property to the users (Kalantari*, et al.*, 2005). This system supports all three models of e-Government. Services for different models are provided under the name of different channel. Conveyancers, banks, legal and real estate professionals are directed through conveyancing channel (G2B). For the government employees and organizations, government channel is created (G2G) and farm channel for citizens (G2C). All the users need to subscribe for the services according to the requirement. No concrete description of key register is found. However, cadastral data (spatial), tenure data (attribute), topographic data, address, feature names, road centerline and administrative boundaries are used for this service. Australian government has established e-Government strategy to support e-Government systems in the country. The

objective of the document is to support more coordinated and focused on citizen centric services in government's e-Government initiatives (DFA, 2006). Regarding the security which is one of the issues discussed in earlier section, Australian government has prepared and implemented Australian Government e-Authentication Framework (AGAF) to support authentication in government services.

Dutch cadastre is also the good example of three models of e-Government. Its online system provides easy access to information and the services to the citizens (G2C). Provision of e-conveyancing through LIS supports G2B model of e-Government. Notaries can sent the electronic deeds through electronic media. The system is citizen centric. Also, data of other government organizations are also distributed through this and its data also can be used by other government organizations (G2G). All these are possible because of the establishment of key registers which was also discussed as one of the issue in earlier section. Regarding the policy, e-Government in the Netherlands is regulated by different laws like Government Information (Public Access) Act (1991), Personal Data Protection Act (2000), E-commerce Act (2004), Electronic Government Communication Act (2004), Electronic Signature Act (2003) (Hof, 2007). The actors related with cadastre like municipality, banks, and other organizations having their own e-Government system based on key register helped in sharing information among the organizations and linking each other and providing easy access to the citizens as well. Large numbers of IT expert are working under Dutch cadastre, which is one of the factors of its success.

In the regional level, Infrastructure for Spatial Information in the European Community (INSPIRE) is one of the good example of SDI which focused in overcoming the challenges regarding the lack of availability, quality, organisation, accessibility, and sharing of spatial information. It is the Spatial Information Infrastructure (SII) operated by 27 member countries and its directive deal with 34 themes of spatial data creating system for access and exchange of information. Cadastral data which is an important component of SII (Molen *et al.*, 2008) is one of the theme (EC, 2010b). This type of concept is very much useful for the issues in land information system which deals beyond the border like European Land Information Service (EULIS) which tries to provide access to information across the border and also support property market. So "no e-Government without land information" (Molen & Wubbe, 2007). Regarding the issues discussed earlier, this kind of system supports citizens from international community as well. Following INSPIRE directive makes the database of different countries interoperable and thus help in sharing and linking data easily, which is one of the characteristic of e-Government. Here, different countries form the actors of the system. Security is the issue that is to be maintained perfectly in this kind of network.

There are different requirements of the system to be e-Government which applies to the case of LIS as well. This resembles more or less with the e-Government issues discussed earlier. The basic requirement is that the system should be online based and citizen centric. The system should be internet based so that the customers can easily access the service and information sitting behind the computer without accessing the offices. This decreases the work load in the offices and thus increases the efficiency of the office as well as staff. Another requirement is the interoperability of the data used in LIS. The data used in one system must be interoperable with other system in e-Government so that they can be linked and service could be provided from one stop shop. The system itself needs to be integrated. It should not be different applications for spatial and attribute database which brings redundancy in that data and also may increase the errors. Similarly, since LIS consist of information about the public property, it should be secured and provide quality service. Adoption of the system by the users depends on the quality of the service and the security of the information. This further link with the privacy as well. There may be some information which is not supposed to be disclosed to all the people. Further, LIS need to comply with the e-Government policy as well. The system need to be capable of conducting electronic transaction. Storing of land information in digital format is not e-Government. The flow of information needs to take place through electronic media. Use of digital signature is another requirement in LIS. For electronic transaction, digital signature is necessary. Similarly, incorporation of electronic payment system is another requirement of LIS for e-Government. Finally, IT expert human resources are very important to run and maintain the sustainability of the LIS.

2.4. Concepts of architecture

Architecture is the representation of system along with its components, relation between them and the product. Architecture must be such a way that it is adopted by government organization as well as citizens.

The components of the architecture need to link with each other, data used should be interoperable and the way of providing information should be identified. Guidelines developed by Tuladhar (2004) for LIS also identified the necessity of information system architecture. Information sharing among the organizations is important to increase efficiency and quality of service, reduction of labor cost and decrease data redundancy (Hobson*, et al.*, 2011) which is one of the expected outputs of e-Government.

SOA is and enterprise architecture which foster reuse of software components and consist of three major components as service directory, service provider and service requestor (Haki & Forte, 2010). On the basis of SOA, Haki and Forte (2010) discussed Inter Organizational Information System (IOIS) architecture. The architecture has three components discussed as layer. First one is business layer, then application layer and integration layer. Though the architecture allows sharing of information among the organizations, it does not explain about database, and other technical architecture. TOGAF have clearly defined Business, Application, Data and Technical architecture. The thesis is focused on business architecture only and tries to link with system architecture and information architecture of LIS.

In any architecture, data security is very critical issue. "In Estonia, attack in IT sector in 2007 briefly paralyzed a majority of the IT-infrastructure of banks, authorities, the police, and the government, which naturally reduced the public trust in e-Government endeavours" (Buhl & Löffler, 2011). Buhl and Löffler (2011) says that Sweden and Netherlands are two pioneers in e-Government who are able to gain people's confidence and trust with 54% of citizen usage and 85% of enterprise usage of e-Government in Netherlands.

The major architectures are Technical Architecture Framework for Information Management (TAFIM), Department of Defense Architecture Framework (DoDAF), Zachman Framework, Treasury Enterprise Architecture Framework (TEAF), Reference Model of Open Distributed Processing (RM-ODP) and TOGAF where TOGAF provides a complete framework and methodology for the development of architecture (Minli *et al.*, 2010). Architecture view discussed by this framework is considered for this thesis. According to this concept, architectures are discussed under four different views as *business, data, application* and *technical architecture.*

Business architecture is the integration of business processes which help in defining the services. The business architecture identifies the functions, process, and information flow for accomplishing the task of an organization. Business architecture helps to understand the complexities within the organization and thus support in designing other functional and technical architecture (Versteeg & Bouwman, 2006). This guides how the electronic transaction occurs within the organization. Thus, while designing this architecture, citizen's requirement needs to be incorporated at most. This defines the quality of the service which is another issue of e-Government as discussed earlier. Security at individual level within the internal users is also checked in this architecture.

Data architecture defines the structure of data that is being used by the system. Data should be interoperable as discussed in the issues. Quality of the system depends on the data used by the system. In broader, data architecture can be incorporated in information architecture, which is the representation of data and information used in the system, supports in designing business architecture. "Information architecture is about organizing and simplifying information, designing, integrating and aggregating data and information, creating ways for people to find, understand, exchange and manage information" (Ding & Lin, 2010). This also shows how the users get access to the information and which data are used for the purpose.

Application architecture is also one of the factors which determine the adoption of the system by the users. The application is to be simple and easy to use for the users to adopt it. Otherwise it may be the reason for failure of the system. This is also related with the quality of the e-Government system. Application architecture needs to follow the business rules and use the data defined by data architecture and connected with technology defined by technology architecture in next paragraph. This is the first stage where the users interact with the system. It follows the workflow and manages business process as well as information to provide the service. It handles the user's application, sends to the process and gives the products out on the basis of available data with (out) changes.

Technology architecture defines how different systems are connected with each other. It addresses the issues like technology used in the system, security of the system and also the quality of the system. How different software and hardware are used, how are the computers are networked within the system and

linked with other system are discussed by this architecture. In broad concept and briefly, it can be represented by system architecture which is a conceptual model defining the components, their behavior and the relation between the components. However, it is necessary that the designed architecture need to address the factors identified by e-Government adoption model, e-Government issues and follow e-Government policy.

2.5. Need of architecture

From the study above, we came up with different causes of failure and success factors of e-Government system. Political desire, strategy and vision, design of citizen centric system, integration of spatial and attribute data in one single system, IT experts and infrastructure, self interest, strong management are the reason behind the success of e-Government system and lacking in those factors cause the failure of it. These factors along with the e-Government issues discussed in previous sections prove the need of architectures for LIS which is based on e-Government models. At first, political will is most important for the establishment of the e-Government. We have discussed the issues of policy in e-Government and without the strong desire and will of politicians and the bureaucrats, formation of policy is not possible. They need to have clear vision and objective of establishing bases and the systems of e-Governments. Relating to other issues, development of single LIS incorporating both attribute and spatial data is necessary for LIS. Similarly, reason of self interest and strong management can be related with the issues of human resource. IT experts are necessary for the successful implementation of the e-Government based LIS.

To overcome the technical factors of failure of e-Government, it is observed that the design of appropriate business, information and system architecture of LIS is necessary. Business architecture helps in designing citizen centric system. It is necessary to define the flow of information and the electronic documents which is used during electronic transaction. This architecture also shows the mode of e-payment system. Information architecture is necessary to define the key registers, show how they are linked and how they are accessed by the citizens and other users. System architecture is necessary to define how the workstations at the district offices are connected to the centre office and with other related offices. How and where the database are stored, how the computers and organization are networked is defined by this technology. Thus, appropriate LIS architecture is necessary to design on the basis of user's requirement for the sustainability of the e-Government based LIS. The human resource working for the system should understand all these architecture. Thus, IT experts are necessary for the sustainability of the system.

2.6. Summary

In this chapter, basic concepts about e-Government and land information system are discussed. Eight different issues as: policy, citizen centric, data and information, technology and infrastructure, quality, security, human resource and actors were identified from the literatures that are to be considered during the development of e-Government systems. Examples on successful e-Government systems from different countries showed that strong willingness, IT infrastructure, citizen centric system and IT expert human resource are the key factors for success of the system. Thus, for the sustainability and successful implementation of the system, all those factors need to be considered while designing the system. Finally the chapter concluded with the necessity of business, information and system architecture to overcome the failure factor of the e-Government system. The methodologies for the research and designing architecture are discussed in following chapter.

3. RESEARCH AND DATA COLLECTION METHODOLOGY

3.1. Introduction

This chapter emphasizes on the methodology followed to conduct the research. Desk research, case study and Technology Enactment Framework (TEF) are used for this research. The next part of this chapter is data collection methodology. The fieldwork was carried out to get current situations and developments in the field of e-Government and Land Information (LIS).The work was to talk with the key respondents from the organizations which are working for establishing e-Government, land administration organizations and the organizations whose business are related with them. The respondents were identified on the basis of the TEF as discussed in the following section. The framework identified different users and stakeholders that are supporting in designing system. It covered from policy makers, decision makers, implementing agencies, supporting organizations, business, and IT officers. Thus, potential respondents were chosen on the basis of those categories.

3.2. Research methodology

Three methods as desk research, case study and TEF are used to conduct this research. Desk research includes the literature review on e-Government issues, developments, success and failure cases and their reasons. Case study includes study on the present status of e-Government and LIS in the case study site (Nepal). TEF includes design methodology and the identification of actors in the e-Government system. These are discussed in detail in different sections in this chapter.

3.2.1. Desk research

The method is based for the literature review of the e-Government and LIS. The method is adopted mainly to find the issues related to the e-Government, causes of success and failure of e-Government and relation of LIS with e-Government. These are discussed in second chapter. The method is also used to study about the e-Government and LIS of the Netherlands which is discussed in further chapter.

3.2.2. Case study

Case study methodology is the most frequently used method in the field of cadastral system research (Silva & Stubkjær, 2002). It is the in-depth study which is grounded on empirical study to investigate the situation in natural settings and multiple source of evidence are used (Yin, 2003). Williamson and Fourie (1998) defined case study, comparison and developing appropriate solutions as the three major steps for developing cadastral reforms. This research also follows the same path. Case study method is chosen because this method support in investigating the interaction between the variables and the complexities in the system that is being investigated in real grounding. It gives deeper and detail information about the system in natural phenomena. In this research, case study is used also to use TEF to find the existing institutional arrangements, organizational settings and technology supporting the information system that is being studied. Data analysis and conclusions from this case study does not give the statistical values and results but gives the in-depth analysis of existing system, requirements and output. For this purpose case of Nepal is taken as a case study for studying about the present situation and developments in the field of e-Government and LIS since e-Government system is still in developing stage and initiated LIS is not e-Government based. Data collection method for the case study is discussed in separate section of this chapter.

3.2.3. Technology enactment framework

Technology enactment framework was introduced by J.E. Fountain in 2001. It is the framework which is used to analyse and make better understanding of ICT and its adoption by the government (Fountain, 2001). It helps to analyse the implementation of the IT and its impact on government organizations (Danziger, 2004) which is considered as output in this framework. The objective IT refers to the software, hardware, digital device and internet. Enacted technology is the perception of the objective IT by actors and its uses. Further, identifying the e-Government policy as the driving force of technology, Cordella and

Iannacci (2010) proposed more comprehensive framework termed as "e-Government Enactment Framework" arguing that the design of technology is much more linked with e-Government policy. However, the framework does not explicitly identify the actors. Thus, the revised framework of Fountain (2001) is chosen for this research.

The actors identified in revised TEF are vendors or consultants, information officers and policy makers (Fountain, 2004) (revised by Hirokazu Okumura) and citizens, business by (Schellong, 2007). Figure 3-1 shows the revised framework with the actors. The thick line shows that the one have direct effect on other whereas the dotted line shows that one has indirect effect on other. Double headed shows that both the actor has effects to each other. Here, the success of e-Government is influenced by enacted technology which is also influenced by business and citizens (Schellong, 2007). This means that the enacted technology must be adaptable by the users for the success of e-Government.

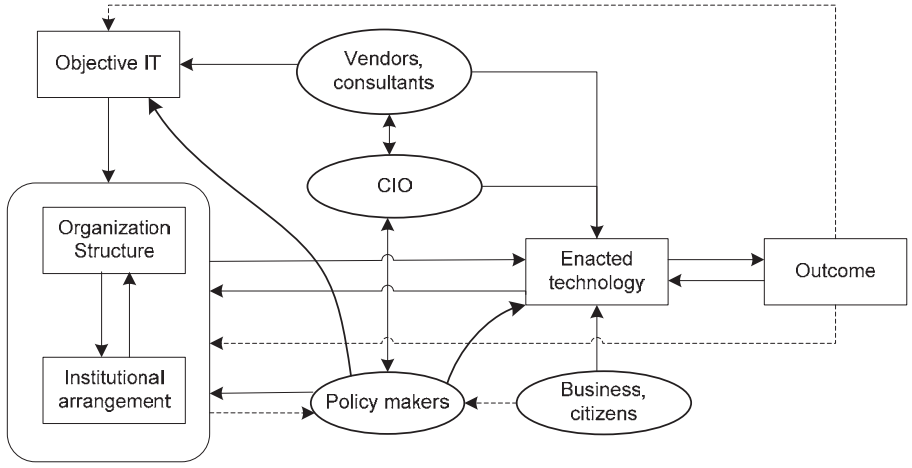

Figure 3-1: Technology enactment framework. (Schellong, 2007).

TEF is recognized as the framework used to analyze the influence of organisational structures and institutional settings on implementation of ICT in public organizations (Yildiz, 2007). According to Yildiz (2007), the framework allows studying relation between technology and organization and how the public organizations endorse the technology according to the organizational and institutional settings. Thus, this framework is followed to find what are the organizations involved in land administration, who are the organizations using the information of land administration organization, what are the legal basis for the business processes in those organization and what are the system (if any) those organizations are adopting by preparing questions for the interview accordingly. The questions are prepared with consideration of the framework to get the answers about all the relations that are identified in the framework. The results are discussed in chapter four. Then after, the designing of the architecture is done, which is the part of the TEF as output (discussed in chapter five).

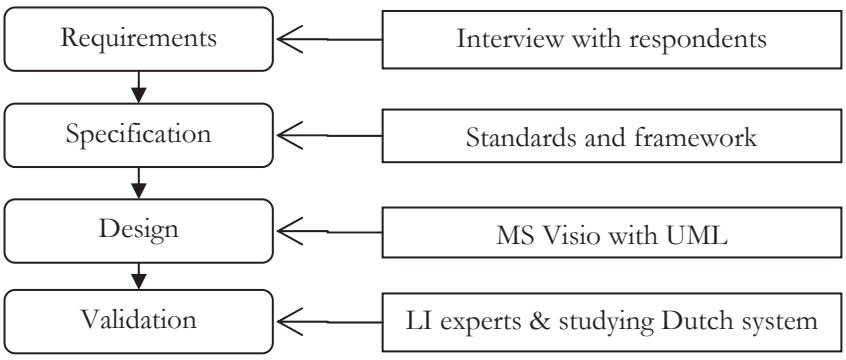

Figure 3-2: Design methodology.

Different design methodologies are defined and there is no single best methodology to be followed. Some of the examples are Structured Analysis, Design and Implementation of Information System (STRADIS), Structured System Development Methodology (SSDM), Soft System Analysis (SSA), Rapid Application Development (RAD), Object Oriented System Development Methodology (OOSDM) etcetera. Some of the methodology does not focus on developing solution but rather focus on understanding problem situation as SSM (Tam, 2010; Tuladhar, 2004). OOSDM uses the entity of real world with the concept of object as the component of system (Tuladhar, 2004) and avoids the gap of the classical models (Tam, 2010; Tuladhar, 2004). STRADIS is the structured process modeling where complex problems are broken down in a detailed process and is most useful for the cases where prioritization is necessary due to lack of resource or excessive demand of system development.

In spite of the necessity of analyzing and defining specification and standards, SSDM has the advantages like involvement of users and feedback from them, validation and well defined techniques. Thus this method is used for this research. Investigation of the current environment is one of the important steps in this method. The successive phase start only when the previous phase is completed (Royce, 1987). In this model, requirements of the system are identified first. Then after, the specifications are defined for the system. On the basis of requirements and specifications, system is designed. The designed system is implemented and then tested. Since the implementation cannot be done within the limited timeframe of this research, this step is excluded. Figure 3.2 shows the design model for this research.

The requirements are identified from the interview with the key respondents identified according to the actors defined in TEF. Thus, the present situation is also analyzed and the requirements were categorized as technological, organizational and institutional. Along with the requirements, standards and framework, specifications are defined and these are the enacted technology according to the TEF which is also understood as adopted technology for designing. This enacted technology is followed to design the architecture. MS Visio with UML is used to visualize the architecture. Designed architecture is the output part in the framework. Finally, the validation is done by the expert in the field of cadastral and e-Government system. Because of the limitation of time for implementation, limited validation of the architecture is done by System Architect from the Kadaster of the Netherlands. The validation was supported by the business workflows and the study of the Dutch cadastral system.

3.3. Data collection methodology

Primary data collection was based on the interview with the key respondents who were identified before going to the field work. During the field visit, secondary data like government documents, reports, acts, rules, regulations and other publications were collected.

3.3.1. Study area

Two districts have been considered for the study site (Figure 3.3). One, Bhaktapur district is adjoined with the capital city of Nepal and another one, Kaski district is in the mountainous region of the country.

Figure 3-3: Study area.

The reason for choosing the sites is that, Bhaktapur district offices have both spatial and attribute data in digital format and in the case of Kaski district, all attribute data have been digitized and digitization of spatial data has been started. However, there may be some differences in workflow or some modifications in rules according to the need of the geographical location and thus it will be possible to find if there is difference in requirement of architecture to satisfy G2G, G2B and G2C model of e-Government.

3.3.2. Designing interview question

All the interview questions consist of open questions to cover the broader range of information. The questions were focused on current situation of the e-Government, LIS and some opinion or experience questions. The questions were designed to get the answers about the relations that are identified in the TEF. Questions about present developments in e-government sector, the organizations involved in land administration directly or indirectly, identification of the users of LIS, availability of rules and regulations supporting LIS, different technologies and infrastructures available at present in LIS were asked. This type of question helped in getting knowledge about the components of TEF like objective IT, organization and institutional settings. Similarly, opinion about integration and sharing of data, assignment of key registers, web based technology, different e-services like e-payment and e-conveyancing and access to information were asked. These types of questions give idea about the enacted technology of the TEF that is used to design architecture as an output. Since the interview questions were unstructured, different issues that arouse during the discussion were also made clear during the interview.

Further, different sets of questions were set up for different actors identified by the TEF according to their organization and positions. The respondents were chosen as such that they represent stakeholders of LIS. The questions were set for different level as policy, decision makers, implementing level, academician, private organizations, IT experts and deed writers. The list of respondents with their respective organizations is listed Annex A. Different question according to different organization are attached as Appendix C. Different questions are prepared for different organizations. In this appendix first set of question is for chief of OPMCM/HLCIT/NITC. Similarly second for secretary of MOLRM, third for director generals, forth for executive officer of municipality, fifth for district land administration office, sixth for computer expert from HLCIT/NITC, seventh for computer experts from DOLRM and DOLIA, eighth for academician, ninth for bank and tenth for professional users.

3.3.3. Preparation of field data collection

Field work plan was prepared in advance before going to the field. Preliminary list of respondents were also identified. The respondents were identified according to the organization who are working for e-Government and who are the users of Land Information System. The user's requirements regarding citizens were already identified by the previous researchers. Thus, this research tried to focus on the policy level and the requirements in the architecture and thus the respondents were also chosen accordingly. The support letter from the ITC for the respondents was prepared which were distributed during the appointments with them. Some of the respondents were contacted through e-mail and telephone as well for the appointment.

3.3.4. Data collection

Interview was used for primary data collection and other documents, reports, publications from different organizations were collected as secondary data (Figure 3.4). Brief discussion is introduced in following sections.

3.3.4.1. Primary data collection

Interview was the main source of primary data collection. The questions cover the opinion, experience and the present status of e-Government and LIS. Office of Prime Minister and Council of Ministers (OPMCM), High Level Commission for Information Technology (HLCIT), National Information Technology Centre (NITC), Ministry of Land Reform and Management (MOLRM), Ministry of Law and Justice (MOLJ), Departments under MOLRM, district organizations, municipality, deed writers, private consultants and academicians were taken as respondents. Details of the respondents are given in the sections below. All the interviews were recorded along with the notes.

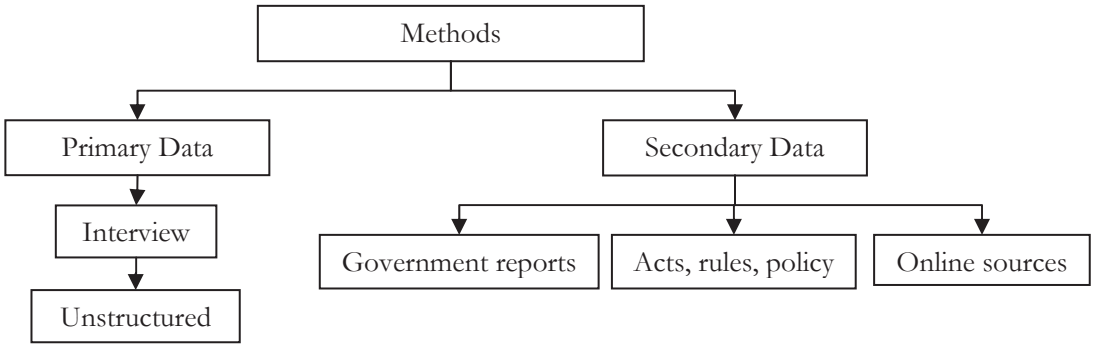

Figure 3-4: Methods of data collection.

3.3.4.2. Secondary data collection

Different consultancy report, progress report and other documents were collected during the field work. e-Government master plan and vision paper of MOLRM was collected form Ministry of Land Reform and Management. Similarly, Electronic Transaction Act (ETA), IT Policy, reports on Nepal e-Government Interoperability Framework (NeGIF), Government Enterprise Architecture (GEA) was collected from HLCIT. Annual progress report was collected from Department of Land Reform and Management (DoLRM). Some of the documents were downloaded from the websites of different ministries and meeting the concerned people as well.

3.3.5. Challenges in data collection

Filed work time was soon after the biggest festival of Hindu in Nepal. So, on the very first day after the holiday some of the staffs were not present. Some of the potential respondent were also absent and thus needed to visit next day. Some of the respondent even didn't entertain and seriously took the interview. Some respondents did not allow recording the interview. Thus, it was a challenge to note down all the statements that were said during the discussion. Postpone of the meeting dates was another problem during the field work which created problem in fixing time with other respondents. Some of the organization chief was out of the country for attending the program. In those cases, deputy chief were interviewed.

3.3.6. Data processing

Data processing was done manually since no complicated analysis was necessary and also the data was easy to handle. All the interviews were recorded and transcribed afterwards in MS word. The interview was conducted in Nepali language. However, while listing, they were translated into English terms. Total 30 respondents were interviewed. List of respondents were grouped as shown in table 3.1

Table 3.1: List of respondents.

Type	Respondent	Number
Policy/decision makers	Secretary	1
	Member secretary	1
	Director General of departments	3
	Under secretary	2
	Assistant director of NITC	1
	Administrative officer of NITC	1
Implementing agency	Chief of district land revenue office	2
	Chief of district survey office	2
	Senior surveyor	1
Supporting organizations	Executive officer of municipality	4
	Junior engineer	1
IT experts	Computer officer of departments	2

Business	Deputy manager of banks	2
	Chairman of deed writer's association	1
	Deed writer	2
Consultant/Experts	ADB consultant	1
	Academician at KU	1
	Private consultant	1
	System architect (Dutch cadastre)	1

3.4. Summary

The chapter discussed about the methodologies adopted for the research. Methods were discussed in two different parts. Enactment framework was adopted to identify the actor involved in producing some output from the existing or available technologies. Another section discussed about the model adopted to design the LIS architecture.

From the interviews key problems were identified as lack of proper system design, strong policy and its implementation, awareness (citizens, government officials and politicians), infrastructure and political stability. It is also seen that the existing LIS architecture is not supporting for e-Government and the system is being upgraded. Developments are seen in the field of e-Government though it is very gradual. However, it cannot be said that the e-Government implementation is failure in case of Nepal.

During the interviews, ethical issues were also considered. When recording the interviews and taking photographs, interviewees were asked for the permissions beforehand. Some of the respondents denied it and notes were taken in those cases.

4. DATA ANALYSIS AND RESULTS

4.1. Introduction

Details of data collection methodology, respondents, sources of information, types of data collected were discussed in previous chapter. This chapter analyses the data collected during the field work and produce the result which is used for designing appropriate LIS architecture. Section 4.2 discusses about the organization structure, institutional settings and existing technology as the result got by adopting TEF. Similarly present status of e-Government and LIS of Dutch system is discussed in section 4.3. Information from this section also supports for the validation of the designed architecture. The responses provided by the respondents during interview and analysis are highlighted in section 4.4. On the basis of this, requirement and existing guideline and specifications for the system is discussed in section 4.5. Following these requirements and the guidelines LIS architectures are designed.

4.2. Current status of e-Government and LIS in Nepal

In spite of some progresses in infrastructure development in LIS, development of e-Government is in initial stage. Lack of optimal leadership flourished with unstable government, motivation and commitment of staff, technological and geographical digital divide, ICT infrastructure, and financial insufficiency are some of the barriers in hindering e-Government implementation in Nepal. However, government is initiating programs to establish e-Government in the country.

4.2.1. e-Government and legal provision

There is a lack of particular e-Government policy. The supporting policy and acts are Information Technology (IT) Policy (2000), Electronic Transaction Act (2007) and Electronic Transaction Rules (2006) and are still segregated which may hinder in rapid adoption of e-Government (Pariyar, 2007). Electronic Transaction Act 2007 was formulated to support computer based service generalized for all government services and is supported by Electronic Transaction Regulations. For supporting land administration, Land Related Act and regulations, Land Survey Act and regulations and Land Revenue act and regulations are formulated. Besides this, Department of Land Reform and Management (DOLRM) have prepared land administration directive volume 1, 2, 3 and Department of Survey (DoS) have prepared cadastral survey directive to support land administration in the field. 83 District Survey Office (DSO) under Survey department and 83 District Land Revenue Office (DLRO) under DOLRM is working in district for land administration, both of the departments which are under the MOLRM. Similarly, on the basis of Local Self Governance Act and Rules, municipality collects land tax and revenue depending on size and location. Further, emphasis is always given in periodic national plan of the country on computer based land administration service and international organizations are also supporting for the strengthening of land administration services. 3 year plan approach paper (2010/11-2012/13) emphasised on the easy access of land information to the citizens.

Despite of the barriers, Government of Nepal with support from Korea IT Industry Promotion Agency (KIPA) prepared e-Government Master Plan in 2006 to establish vision, strategy and framework of e-governance in Nepal (Pariyar, 2007). Vision of the plan is to build a citizen-oriented service by providing on-line government service using ICT, to standardize government administration process, computerize administration, to provide integrated information and service and to share administration information to enhance effectiveness of service (HLCIT, 2006). To support this plan, Office of Prime Minister and Council of Minister's office (OPMCM) is coordinating e-Government project with the support from ADB. Initially, 21 projects were identified for execution with the estimated budget of 65 MD. But, because of the insufficiency of budget finally only 8 projects were prioritized for execution with the estimated budget of 31 MD. The budget was as 25 MD supported in grant by ADB and 6 MD by the Government of Nepal. The project component "Land Records Information Management System" was also included. At present, the project is in the state of bidding consultants.

However, most government organization has their websites at this moment in spite of the in-house unavailability of expertise. The information can be achieved through their websites though it may not be

sufficient. Thus it can be said that Nepal is in 1st stage of e-Government development phase according to Layne and Lee (2001) (Figure 2.1).

4.2.2. Technological status

Government of Nepal established Department of Land Information and Archives (DoLIA), a dedicated department to manage and supply land information easily (Tuladhar *et al.*, 2002). This is the central organization to manage all digital databases of the district land revenue and survey offices. Digitization of the attribute database has almost come to the end but that of spatial data is just started. Proper LIS architecture is not developed in Nepal yet. Thus, the country has not been able to go for electronic transaction. The entire digital databases are isolated in different districts. At present, DLRO has its own separate database on MS Access platform and DSO is developing its own separate database in MS Access platform. Among 83 district offices, digitization of land records of 82 DLRO and 29 DSO is complete. One revenue office is not complete because of the total destruction of the records during the armed conflict. At present, 40 DLRO and one DSO are providing computer based services but is in parallel with paper works also. Digitization process is extended to other offices. In spite of the existence of digital database, customers cannot get required information easily.

Though the district offices have isolated system, department have initiated to establish Virtual Private Network (VPN) to connect the department and the district offices. Initially, five district offices of Kathmandu valley is being connected to the central server at the department (Figure 4.1).

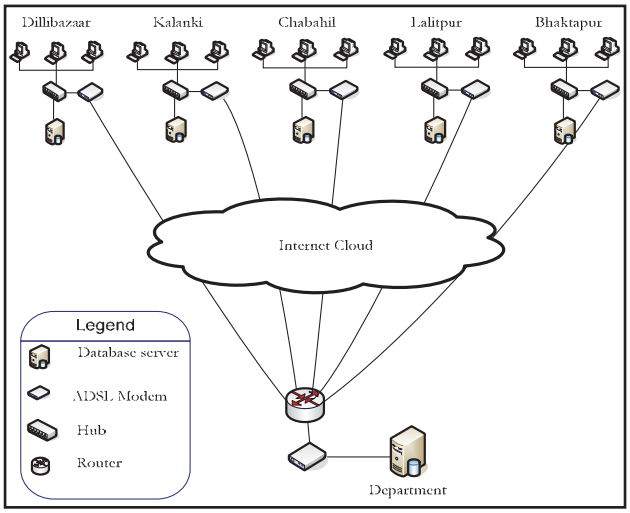

Figure 4-1: Virtual private network between 5 district offices.

Regarding the taxation system in municipality, they have also developed their own information system as Tax payer Management Information System. Same as District Land Information System (DLIS), this system is also isolated in individual municipality. Customer goes with the copy of ownership certificate and the office staff inputs the information according to the certificate provided. Every next time the customer goes for paying tax, the staff needs to enter the information again. Information like area, ward no., location, parcel number and land use type are entered. If any information required by the municipality, they ask through the written letter and the land administration office also replies through the written media. Same is the case with the banks as well. Whenever banks need information from the land administration organization they communicate through written letters and answers are also provided in written format. The payments for any services are made either through cash or cheque.

4.3. Current status of e-Government and LIS in Netherlands

4.3.1. e-Government and legal provision

"The Netherlands' e-Government performance shows a more mixed picture, with close to average online availability and high rates of business and individual use of e-Government. It is a mature information

society with traditionally high internet use and broadband penetration; thus providing a strong environment for the deployment of e-Government" (EU, 2010). e-Government in the Netherlands is regulated by Government Information (Public Access) Act (1991), Personal Data Protection Act (2000), E-commerce Act (2004), Telecommunications Act (2004), and Electronic Signature Act (2003). The body responsible for laying down the e-Government policies and strategies is the Ministry of the Interior and Kingdom Relations. Since it is EU member country, it also follows the rules and regulations of the EU like INSPIRE and European e-Government Action Plan. According to EU (2010) e-Government is considered as a part of the country's wider ICT strategy with a focus on delivering services in more efficient way and reducing administrative burden. The e-Government strategy is guided by the government-wide implementation calendar of e-Government service i- NUP (National Implementation Plan), which describes the plans for the next four years. The ICT Agenda 2008-2011 gives the overview of the Dutch government's plans on ICT with e-Government as key priority area.

Major issues addressed by the Dutch e-Government policy were privacy, government communication, reliability of e-Government, efficiency of the service, interoperability of data and access and re-use of information (Hof, 2007). Legislation for the electronic highway in 1998 discuss about the need of electronic communication which came into action after the change in Administrative Law Act to accommodate electronic communication in 2004. Electronic Government Action Program in 1998 address about the necessity of reliability in e-Government along with authentication, information security, digital signatures and chip cards. This policy was further supported by the Legislation for the Electronic Highway in the same year. The policy document Modernizing Government in 2003 mentioned about the use of standards for electronic data exchange in public agencies. 1998 Government Action Program and Government Information (Public Access) Act (1991) support in access and reuse of the data and information.

The objective of the e-Government is to make the public sector information easily available and obtainable to the citizens. It also focuses on reuse of the e-service and the data which brings the concept of key registers. The concept of key register is developed as the database which is maintained by a single government body and used by many others as the authentic source and once register is formally designated as an authentic register, all other government organizations are strictly forbidden to collect the same data by themselves and thus use the key register as a source (Molen, 2005). This reduces the necessity of multiple data collection, storage and dissemination thus decreasing the redundancy in data. The government guarantees on the availability, access, continuity, updated and quality of the database (Molen, 2005). Another positive part of key register in Netherlands is that if a user of the key register detects a mistake in the register, the user is by law obliged to report it to the source which then by law is obliged to do research and improve or repair the data (Ellenkamp & Maessen, 2009). Registers of persons, address, company, buildings, cadastral and topographical maps are already assigned as key register in Netherlands.

4.3.2. Technological status

In the Netherlands, spatial and attribute databases are integrated and all the cadastral maps are fully coordinated (Molen, 2010). The cadastre organization consists of one central office with 15 regional offices. All the transactions are conducted electronically. The citizens have online access to the information about their property through mijn.kadaster.nl. The LIS in Netherlands is user driven rather than technology driven. The government is providing with the technology what citizens want. Customers expects digital data in very short span of time, actual, quality, integrated administrative and geometric data from one stop shop (Dijkstra & Booij, 2003). The system is working online 7 x 24 hours. The data is only owned by Dutch cadastre following the concept of key register and also connected with other key registers.

Since 2005, deeds can be electronically lodged by the notaries. After deal between buyer and seller, notary prepares deed and is registered in land administration office. They have their own application to see the cadastral database. Thus, the cadastre office has two repositories for users. One is for external (notaries and citizens) and another for employees. However, being an employee, he/she have no right to look into the database but as and citizen the employee also has their own user ID and look for the information. Security checking for different user is different. For employee, there are two security levels. One is the user ID which is used to log in to the system. Then after, user is provided with the SMS code in the mobile to verify the user. Regarding the notaries, they are provided with the certificate given by certifying

authority working for the government. They use the private key included in the certificate during application. Thus, to verify them, the organization uses the public key.

Database server facility is provided by private organization. So they are responsible to provide capacity of the server necessary to do the business. Also the one database is in Apeldoorn and another mirror copy is kept in Deventer to provide 24/7 hours' service. Thus recovery test is also performed twice a year if the application can be moved from one datacenter to other. At present the platform of the land administration system is IBM mainframe and the database is IDMS.

There are eight key registers among which cadastre is also one of them. All the key registers are interlinked with each other. Regional offices connect this key registers through the central datacenter. Five among eight of the registers are organized by Dutch cadastre. So they can be easily accessed through the Dutch cadastre and for other registers, they connect through specific API.

Land information system is set up in multi tier concept of client server architecture. Regional offices, notaries and citizens are clients and they use the database in the centre. But the applications are different. Like for example, notary use Splits to divide parcel, the application which is running in the computer of notary but using database from centre. Citizens also use the web browsers to get the information from the central database. There is no database in regional offices. All the database are centralized. Thus, the users in the regional office connect to the database through the application in the centre based on citrix. They log in the desktop of the centre and thus conduct the job. Only screen information is exchanged between regional and central office. The system is server based computing, meaning there is desktop running in the datacenter and screen information is on desktop in regional office.

Further, every citizen has unique digital ID on the basis of citizen service number. Dutch government has repository for authentication and authorization. This ID is used to get the e-government services. Through this ID, citizen can look into all key registers. They can see how they are registered as a citizen, their address, date of birth, property, license of vehicle etcetera. They also have a message box where government can send message through e-government service or if there is any changes then inform about it. Financial matters are all conducted through e-payment gateway. Most of banks are linked with government system for e-payment. The LIS of Netherlands holds all three models of e-government.

4.4. Data analysis of case study

The results got from the interview were grouped under different themes. The results are discussed in different tables.

Table 4.1: Response on policy issues.

Existing policy and the gaps
▪ Electronic transaction act and rules (ETA/ETR)
▪ Use of biometric data not defined in ETA but it can be used by making government decision
▪ Use of biometric data is just technical issue which may not be necessary to address in act.
▪ IT policy is weak in addressing spatial data and no specific e-Government policy
▪ There exist different land relates laws (approx. 65)
▪ Integrated land law is necessary which also include clauses on electronic transaction.
▪ Or add some clauses in existing land related acts for electronic transaction
▪ Or prepare different directive which incorporate all missing clauses

Electronic transaction act is "legal provisions for authentication and regularization of the recognition, validity, integrity and reliability of generation, production, processing, storage, communication and transmission system of electronic records by making the transactions to be carried out by means of electronic data exchange or by any other means of electronic communications, reliable and secured" (GoN, 2008). The act clearly defines about the use of digital signature but fails to address the issue of biometric data. Still the act is not implemented. According to clause 13, Government assign Controller to issue license to certifying authority. Certifying authorities are the one to issue digital signature certificate. But none of the initiation has been taken to implement this act. Digital signature is one of the most important and base for electronic transaction. Thus, necessity of much more pro-activeness of the government is

observed for the implementation of the act. Government agencies can prepare directives according to the requirement to conduct electronic transaction.

Though there exist 65 land related acts and regulations, it does not give negative effect in service delivery. 65 acts and regulation does not mean that all clauses of them come in use. Only some clauses are distributed all over the documents. Thus the integration of all those laws as also identified by Subedi (2009) and Ratnayake (2010) is not necessary. DOLRM have already published "Collection of Land Related Acts and Laws" which collected all the scattered clauses in one single book. Further, addressing specifically about spatial data in IT policy is also not necessary. It is not the document to describe about spatial data or attribute data. However, e-Government policy is necessary so that it can play as supporting document in implementation of e-Government.

Table 4.2. Response on status of e-Government and land information system in Nepal.

e-Government development status
▪ e-Government master plan prepared in 2006 and no updated document after that. ▪ On the basis of that plan OPMCM is coordinating ICT development project which consist of 8 components as: - GEA/NeGIF by HLCIT - Government groupware and GIDC by NITC - Develop NID by MoD - Land records information management system by DOLRM - Vehicle registration and driving license by MoTM - Broad band service in district level by NTA - HRD by MoGA and recruitment system by PSC ▪ Among that final report of GEA and NeGIF is published ▪ Tele-center at different VDC is established but not active due to reluctant government
LIS (digital database) status
▪ Digital database of 82 district land revenue office (among 83) has been completed ▪ As that of district survey office, cadastral maps of 29 offices have been digitized ▪ 40 land revenue and only one survey office have started digital transaction. ▪ The updated database are sent to DoLIA periodically

From this result it is seen that no recent document related to e-Government after 2006 was noted. The project documents for the ADB supported ICT development project were prepared on the basis of the e-Government master plan, 2006, which is already 5 years back. The project document prepared on the basis of 5 years old master plan cannot address the requirements of present situation. In this fast growing environment of e-Government, many changes and development must have been gone through. Thus, the master plan need to be reviewed again and the project also need to be updated accordingly.

For the e-Government, internet facility is also one of the important infrastructures. In Nepal, whole country is not covered by internet facility. To overcome it, concept of telecenter is developed. The centres are developed but cannot boost up in providing services to citizens because of the government itself. The political leaders and the government officials are not active in strengthening the centre. They are not IT experts and thus do not understand the necessity of IT. There exists kind of tug-of-war between the organizations for the power. Recent proposal of Ministry of Science and Technology to dissolve HLCIT which is under the ministry but with same hierarchy in position is an example, the proposal which has been suspended by Supreme Court. HLCIT is one of the organizations to support e-Government and establish telecenter to provide modern ICT facilities in rural area like internet, email, and fax etcetera using facilities like ADSL and CDMA for internet connection. This organization needs strengthening not dissolve. Nepal Wireless Networking Project (NWNP) has established wireless connectivity in more than 150 VDC of the country (Thapa, 2011). Extension of this project can also help in establishment and strengthening of other telecenter in rural areas. The centre can prove very important infrastructure in present situation of e-Government initiation from private sector and holds possibility to build up as good example of Public Private Partnership (PPP).

Similarly, creating digital database of DLRO is finished and that of DSO is still in progress. This gives the problem that the total number parcel in registration and survey office may not be same since the

registration office are updating and survey office are not updating. Also, after digitization of the cadastral maps it should be cross checked with the data of revenue office which is never done. This brings inconsistency in the database of two offices working for land administration. This gives the conclusion that there is need of single application for both the offices and the errors can be eliminated when transaction occurs in future.

Table 4.3: Response on technology and infrastructure.

Opinion about GIDC of NITC
▪ It gives more security of the data in present context ▪ Integrated system within GIDC should be developed ▪ There should not be multiple database but integrated system of individual database ▪ Connectivity of central office with GIDC is defined ▪ Concept of disaster recovery site is being developed for GIDC as replica of it. ▪ GIDC should work as groupware not only for G2G but also G2B and G2C
Electronic transaction
▪ ETA governs almost all issues but problem in implementation ▪ At first the system should be web based ▪ DLIS being upgraded to use finger prints and scanned photographs ▪ Requirement study and system development is not done for electronic conveyancing and also should be legally strong. No separate policy but the government decision is necessary ▪ At this stage e-conveyancing will be over ambitious and will be more mess
Land Information System Architecture
▪ Microsoft Access based District Land Information System (DLIS) in practice and being transformed to MSSQL based in revenue offices ▪ Spatial Application Extension (SAEx) and Parcel Editor in practice. ▪ Both the systems are isolated in different district offices ▪ Within the Kathmandu valley, database are directly stored to central server of DoLRM through Virtual Private Network (VPN) ▪ Developing integrated land information system in district office and establishing DoLIA as CLIA is conceptualized ▪ Existing architecture does not support e-Government, it's just digitized ▪ The application should be web based, DoLIA will host central server, replicate data can be in GIDC

Concept of Government Integrated Data Centre (GIDC) has been developed and established. The main idea is to include all the database of government agency in the same building. This helps in the security of the data but the security system of the centre should also be strong. Firewall at different level may need to be established. Establishment of disaster recovery site is another positive step of GIDC whose concept is to establish back up of the database of GIDC at some other place to keep is safe from disaster.

As said earlier, ETA is sufficient for electronic transaction and electronic conveyancing as well. But, it is seen that there is lack of system and the willingness and awareness of the staff. Paper system is one of the main causes of corruption at this situation where manipulation of records, creating arbitrary task and create opportunity for bribery. Recent case of replacing photographs of the owner and selling the land shows the extent of corruption that occurs in paper system. Thus, electronic transaction system support in reducing corruption as well. However, the present application does not support electronic transaction as well as online information supply. The system is just meant to record the land information in digital format only along with paper work which is absolutely not e-Government. This is creating duplication of the task.

For the e-conveyancing as well, web based application support it. Writers can access the information to check the details and also send the deeds electronically to the organization. But for this also, basic infrastructure like provision of digital signature and web based system is necessary at first step. Users also prefer to have online service. For this service they are willing to pay as well. It is totally disagreeable that the e-conveyancing will be over ambitious and mess. This is also the part of the electronic transaction. Technically it is not difficult to develop such system. The only problem that may arise is the implementation of the acts. Further, there exist geographical digital divide as well. Users in rural area does

not have easy access to internet and also not aware about these kinds of facility. Intensive awareness program is also necessary in this case.

At present, DSO and DLRO have two different databases. So there may be problem in synchronization between two databases. The total number of parcels in both offices may not be same since updates are not being done simultaneously. Also recently, digital database of DLRO are being converted from MS Access to MS SQL and that of DSO is still in MS Access. This may bring problem in data integration and thus need to prepare another system to integrate these databases even. Use of VPN is good in collecting data in centre. But the cost becomes higher for this kind of system. Every district office need to have database server which will further increase in operation and maintenance cost. Thus, web application is the option for this system. Then, every district need not to have separate server which will reduce maintenance cost to some extent. The office only needs basic computer infrastructure with internet facility.

Table 4.4: Response about actors.

Organization structure
▪ Survey and revenue offices are separate and handling separate systems ▪ Priority is given in constructing both the buildings in same premises or close by. ▪ Integration is necessary in future. ▪ Organization integration and reallocation of task shall be defined later after finalizing the federal system of country. ▪ Options could be re-organize and strengthen DOLIA ▪ Another could be merging cadastral branch of survey department and land administration branch of DOLRM and integrate in district as well ▪ Third could be establish LIS Division in ministry so that it can reduce the problem of coordination among the departments
Regarding council or committee
▪ Strong committee or council is necessary for effective implementation. ▪ The council could be the technical group who have only the role of advisory but should have one working group ▪ Involve private organizations and other associations as well in the working group
Use of financial organization
▪ Some private banks have already developed system and started the transaction (e-banking). ▪ The banks have one system department equipped with system engineers ▪ If government wants and willing to co-operate, banks are ready. ▪ Some government banks have not developed such systems. ▪ Law should clearly define the e-payment system ▪ Infrastructure and other system are not developed yet in land administration organization for e-payment service ▪ Trying to cooperate by establishing one bank counter in office premises ▪ E-payment will reduce corruption

Two separate offices for land administration are not giving efficient service to the citizens. For the single task they need to visit two different offices which are under the same ministry. In some of the districts two offices are quite far away from each other. This is also affecting more in the efficiency of the office. Thus integration of the organizations is the must. However, since the country is going through federal system, organization system as well as work division may need to be redefined. So this can be done after finalizing the federal system. Though, one IT department is very necessary for successful implementation of LIS. DOLIA is established with the aim of establishing LIS in the country. Thus, this department can be extended and strengthened as IT department. The department should then be run by technical people and sufficient numbers of IT experts are to be appointed.

Besides land administration organizations, other offices like municipality, district administration office are concerned with land administration. Coordination and cooperation between the organizations is very essential in implementing e-Government. Single task is also concerned with number of organizations. Lack of cooperation brings inefficiency in the government service to the citizens and thus increases in grievances. Another issues discussed during interview was about the formation of committee or council for the implementation of e-Government. Analyzing the previous scenarios, it shows that most of the

councils were politically influenced. In spite of focusing on the objective of the council, they always get busy in political issues about hiring and replacing the members. Thus, it is most important that the formation of council must be totally out of political influence and the members must be technical people who should be aware about their job and responsibilities rather than keep quiet and accept salary.

E-payment is also another part of e-Government. Some of the banks have started collaborating with some of the government organizations. E-banking system is already developed for this purpose. Use of those banks for e-payments will reduce corruption since fixed prices are to be paid online. Clause 40 of ETA supports for any kind of document and payment made on electronic form or through electronic media. So there is no further requirement of law or directive for this purpose. This is rather better than establishing bank counter in the office premises. This needs more space, again paper work, more staff and thus more costly in comparison to e-payment. E-payment also reduces corruption. As machines are used for the process, it will not ask for more than what the system calculates.

Table 4.5: Response on data and information.

Opinion about assigning land information as authentic register
▪ Study is not done in detail for this purpose and accuracy is not sufficient ▪ Land information is not only data to make authentic ▪ Different data are produced by different organization with different objective ▪ The data of other organization concerning with citizens should also be authentic
Linking government database
▪ To link the database, all the organization should have web based application ▪ Linking and sharing database help in decreasing data redundancy ▪ NID is necessary for this purpose ▪ Database of different government organizations are not interoperable at this moment ▪ All the database of government organization should adhere to NeGIF
Online information
▪ People are not aware till date ▪ Awareness program in VDC level is in build in project component of HLCIT ▪ System is not developed for such facilities ▪ It will decrease in flow of people in office ▪ Electricity problem ▪ Develop strong security system and define legal aspect ▪ 60-70% information can be provided online ▪ Users are willing to pay for online service

From the interview result it is seen that the concept of key register is not developed yet. Still, some of the respondent address that all the database relating to the citizens should be authentic and the accuracy should be maintained. Assigning key register helps in reducing redundancy in the databases. As the key register is assigned, all other database should follow the same database and cannot produce other data for same purpose. But still, assigning all public related data as key register may also not be logical. Development of key register is most essential task for initiation of e-Government. These are the base and authentic data of the government which all other organizations should follow and use. In case of Nepal database like personal data, address data, land register, company data and NID can be assigned as key register at the moment. The list can be increased in future according to requirement.

Also, integrating government data does not mean that just storing data in the centre. If it is so then the centre will be just like repository centre rather than integrating centre. Thus it is observed that the integrating system is necessary in the centre which can link all the database. For this also, all the database need to follow common framework i.e. Nepal e-Government Interoperability framework. Web application is another system that support in integrating the data. Web application helps in integrating digital data as a form of one stop portal and thus reduces processing cost, infrastructure establishing cost, easy access to information and increase quality of services (Zakareya & zahir, 2005). Web application will help citizens to get access to the information easily.

Table 4.6: Response on human resource issues.

Human resource
▪ In present situation all the government officials must be IT literate, not only the operators ▪ Due to lack of IT expert in OPMCM, decrease in effectiveness of decision making in the project ▪ Two permanent computer engineers are appointed in DoLIA and DoLRM one each and one is appointed in contract in DOLIA. ▪ Computer engineer post in Ministry of Land Reform and Management is vacant ▪ All the district offices have post of computer operator but not completely fulfilled ▪ Understanding being developed that the administrative staff should be trained in computer nor adding more computer operators ▪ Program of HRD is specially identified in Vision paper 2011. ▪ Coordination with land management training center and DOLIA, training will be conducted ▪ For the time being people are hired in contract where necessary ▪ No computer engineers (IT experts) in municipality

It is seen that the government organizations lack IT literate human resources. The Ministry of Land Reform and Management in a whole has only 3 computer engineers. Ministry concentrates only in fulfilling the computer operators in the district offices. But for the success in implementing ICT, all the staff should be IT literate. Ministry holds one separate department, Land Management Training Center (LMTC) for the development of human resources. However, the center is just providing training for surveying and mapping. Thus, this center also needs to conduct training on ICT. Vacancy of one position is not a great issue which even fulfilled cannot be sufficient. More positions for the IT people needs to be created. Extension of coordination with the university is another way of developing human resources. Some universities produce very few graduates in IT. Those also either go abroad or join some private organizations but not government because of very low salary in compared to private organizations.

4.5. Requirements and specifications

The requirements are identified from the respondent's interview and the results from the previous research done in land administration for Nepal. Interview during the case study was done to get the idea about requirements in G2G and G2B. Thus the respondents were also chosen accordingly. Requirements in G2C are collected from previous research. Thus, local people were not interviewed. Then after, specifications are defined according to different reports published on Government Enterprise Architecture (GEA), NeGIF and other international standards. These requirements and specifications are further used for designing purpose.

4.5.1. Requirements for LIS

Requirements for LIS are identified after transcribing the interviewed data. Interviews were transcribed and clustered accordingly. Then the results were analyzed under different themes. The analysis of the interview data was done in previous chapter. Requirements are discussed in three different aspects as below.

4.5.1.1. Technical requirements

- **Adherence to NeGIF and GEA:** The applications, data and the connectivity need to follow the guidelines defined by NeGIF and GEA. These are the guidelines developed by HLCIT for supporting interoperability among the government and finally supporting e-Government. NeGIF provides a framework to share, collaborate and integrate information and organisation processes by use of common standards (HLCIT, 2011a).
- **Web based system:** The present system that is being used in the district offices are isolated single application based system. All the offices have their own database server. The service that the offices are providing is not e-Government based but just conversion of the paper to computer system. Thus, development of web based system is another requirement (Ratnayake, 2010; Subedi, 2009). This supports all three models of e-Government. Use of ICT and web technology helps in interaction,

participation and collaboration between government portals along with easy exchange of information between government organizations and the users (Sandoval-Almazan & Gil-Garcia, 2012). Web based e-bidding system in Nepal have brought transparency in bidding procedure. Research by Reddick and Turner (2012) shows that government websites were most commonly used for getting information rather than using phone or visiting offices.

After the development of web based application, it will also be possible for providing online information to the users. At present, people go the office and search for the required information in the paper records. They even have access to paper maps. This decreases the security of the maps. The maps may even degrade or get lost also. Online information supply reduces such risk and also reduces public flow to the office, thus reducing the crowd and maintain good environment for the service. Information is used by the municipalities, deed writers, banks and the owners themselves. If bank wants to get some information or municipality wants some information, they then need to send written request and the land administration office also send back the written information. This reduces the efficiency as well. This type of problems will be eliminated by online information system. From the interview, it is known that the users are willing to pay for this type of services. For this payment they should be provided access to their own data. This helps for the citizen to know about what the government knows about themselves.

- **Provision of e-payment system:** E-payment is another requirement in e-Government (G2B). Some private banks have started collaboration with the government organization for this facility. The machine will never charge extra money than it is programmed. Thus, this kind of facility helps in reducing corruptions.
- **Use of NID:** NID is another requirement in e-Government system. This gives the unique identification number for the citizens. It helps in integrating the government database related with citizens. This reduces the duplicity of the personal identification.
- **Integrated LIS:** As stated earlier also, two district land administration offices have two different applications and two different front-end and back-end supports. This brings the causes of discrepancy in the database also. Due to this, citizens need to visit two different places for the single task within the same umbrella organization which may increase the cases of corruption as citizen may need to pay extra money to get the job done at two places. Thus, integrated LIS is identified as another requirement. Integrated LIS here means the integration of spatial as well attribute database.
- **Data security and quality of service:** Quality of service is most necessary to be maintained in order to satisfy the customer which leads to the sustainability of the system. The system need to be easily understandable, usable and adaptable to the citizens. Efficiency is expected to increase by the implementation of the system. Quality of service includes capacity of the system in terms of number of services in given time, reliability in performance of the job and compliance with the standards and frameworks. Another quality aspect is the security of the web applications and data. The system should be secured from the identity theft and also the destruction of the database.
- **Availability of internet facility:** Internet is one of the basic requirements in e-Government. Without internet no e-Government application can run. In Nepal, ADSL, CDMA, broadband, fiber optics, wireless are being used in recent days. Wireless is seen more effective in case of Nepal where there is more rural area without access of telecommunication network like ADSL and CDMA.

4.5.1.2. Institutional requirements

- **Policy, rules and regulation:** From the field visit it was found that there is lack of policy on e-Government. The acts and rules that have been prepared like ETA/ETR are still not implemented. Thus, it is identified as the requirement that e-Government policy is necessary. Along with this, preparation of e-Government strategy is another requirement to implement the system to meet the objective within the limited time frame.
- **Electronic services:** Electronic service does not mean digitization of land records and just producing ownership certificate prints through computer, what is being done recently in Nepal. All the process should follow specific workflow and the information should pass electronically. Thus, electronic transaction is another requirement which support G2B and G2C models.

- **Directive for electronic transaction, e-payment and e-conveyancing:** Electronic transaction act have the provision of appointing the controller by Nepal government who issues license to certifying authority. Certifying authority provides digital signature certificate (GoN, 2008). The act define electronic record as " data, record, image or sound transmitted, received or stored in an electronic form by generating the same through any means" and article 4 of the act provides its legal validity. Article 40 supports any document and payments that is submitted or paid to other organizations in electronic form or any other electronic mode. Thus following this act, MOLRM can prepare a directive for electronic transaction. Many banks in Nepal have started e-payment for government organizations. FAO (2011b) also identified the potentiality of e-conveyancing in Nepal. These covers all three models of e-Government.
- **Assigning key register:** Till date, no any government data are assigned key registers and the concept is also not developed yet. Personal data, land register, topographical data, business register, building register, address register and register on real estate value are assigned as key register in Netherlands. This means everybody should use the same database for their purpose. In case of Nepal also this is identified as requirement. If it is not done, then every organization will produce own data and thus there occurs redundancy in the database. This brings about the repetition of the data. Like for example, district administration office have the information about the citizenship information. On the other side Election commission is creating its own separate voter register which is totally duplication of database. The commission can use the information from the district offices. Thus, concept of key register eliminates this kind of redundancies.

4.5.1.3. Organizational requirements

- **Integration of land administration services and offices:** Another requirement observed is integration of land administration service and the office as well. Separation of services as registration and survey produces duplication of work and time delay as well. Duplication of work, unclear jurisdiction, more stops and complex procedure are some of the problems in present organization structure (Subedi, 2009). One IT department is necessary for sustaining e-Government system. Thus, it is observed that DoLIA needs to be upgraded and handle the district offices after integration into one district office.
- **Integration of data into GIDC:** Concept of GIDC is to integrate all government data in one single place. This supports in access to all the data from one single port. Thus, data integration into GIDC is identified as another requirement in e-Government. This helps in integration, linking and sharing of data with other government organizations like municipality which is one of the government organizations who have link with land administration data in their process. All the property tax is collected in municipality. They use land ownership certificate for this purpose. During the time of land transaction, they give the valuation report and the property tax clearance receipt. Municipalities are the responsible body to prepare the cadastre data. Thus, sharing of data among the land administration organization and the municipality brings efficiency in the service (G2G). Collecting valuation report and tax clearance receipt also consumes more time during land transaction (Ratnayake, 2010; Subedi, 2009). If the databases are linked then this time will be reduced. Recent research in Taiwan also shows that centralized system helps government organizations to share information among each other easily (Yang *et al.*, 2012). Thus, all the government data need to be integrated within the GIDC. This also helps in securing the database. Resource and infrastructure for security can be focused in only one place.
- **IT man power and upgrading IT knowledge:** In e-Government IT people are one of the key actors for the sustainability of the system. Under the ministry there is lack of IT expert human resource. Thus, need of IT man power is another requirement identified. After integration of the district offices, DoLIA is to take over the offices and need to be fulfilled with highly qualified IT man power and establish as IT department. Organization can not hire consultants for its system every time. Thus for the sustainability, it should have its own IT experts. This will help in maintaining and sustaining the LIS by the availability of continuous expertise within the organization. One of the ways is to run the graduate course for IT and retain the outcome in the government organization with handsome salary. One of the reason IT people not willing to join government office is the salary that they get in private organizations or opportunities abroad.

- **IT service management:** IT is a continuous developing field and the system based on IT requires continuous management for the sustainability of the system. Management could be for service delivery, service support or infrastructure management. Security, financial, capacity and continuity of the service management need to be considered for service delivery. Similarly, problem, changes and helpdesk management should be addressed for service support and network, operation, computer installation and system management for infrastructure management. More details of different management are discussed by Information Technology Infrastructure Library (ITIL) as shown in Annex D. Finally, to support all those management, highest level in the organization must be IT representative.
- **Coordination and flexibility:** It is seen that there is lack of coordination within the government organizations. Different organizations like municipality, banks, survey office and revenue office are engaged in land administration process. Thus, regarding the access to information, coordination among these organizations is very necessary and integration of district land administration office will help in increasing efficiency of the services in coordination with other organizations (Subedi, 2009). Flexibility in organization means that whenever necessary, the organization should be capable of establishing branch office according to the necessity and merge easily when not necessary. But this should be backed up by appropriate legislations.

4.5.2. Specification

Government of Nepal, have just released Nepal e-Government Interoperability Framework and Government Enterprise Architecture. Some of the specifications defined in the framework are also from international standards. Thus the specifications here identified are based on NeGIF, GEA and some international standards.

4.5.2.1. Network and connectivity

Internet is the base of e-Government. Every organization should have internet connectivity. ADSL, CDMA and wireless are commonly used facility in Nepal. According to NeGIF, application servers should provide support for various standards adopted for web services. GEA have defined connectivity within the government organizations. All departments within Kathmandu should connect to the Singh Durbar on Fiber Optic connectivity 5 MBps bandwidth. The district offices should be connected to the department and Singh Durbar offices with at least 256 Kbps broadband having 1 MBps bandwidth. Similarly, the villages can be connected to the district offices using wireless or other connectivity on at least 256KBps bandwidth network (HLCIT, 2011b).

4.5.2.2. Application

- Webmail should be used as official email suite rather than external free web mails.
- Secure Hash Algorithm should be used as a standard for digital signature.
- PKI should be used for communicating confidential information in banking sectors and other ministries.
- Web browsers should support HTML 4.01, XHTML1.0, CSS 2.1, ECMA Script. The major web browsers are Internet Explorer, Mozilla Firefox, Google Chrome, Apple Safari, and Opera for Windows and Apple Safari, Mozilla Firefox and Opera for Macintosh.
- Technology/ software products that comply with OGC's Open GIS Specifications and protocol such as Web Map Service (WMS) and Web Feature Service (WFS) should be used.
- Wireless Markup Language (WML) version 2.0 should be used for development of content for mobile/PDA (Personal Digital Assistant).
- Scripting languages should allow code portability, code collaboration, and browser compatibility and should follow ASCII as the basis.
- PCI can be considered for cardholder data and PIN security for online payments as best practices for payment application development.
- EMV can be considered for physical and electronic requirements of payment system IC cards.

4.5.2.3. Data

- UML should be used to specify, modify, construct and visualize data
- XML should be used for data description and electronic data interchange

- KML, GML, WFS and WMS are recommended for spatial data visualization
- Database management system should provide support for the basic properties of a database transaction: (ACID) Atomicity, Consistency, Isolation, and Durability
- Database technologies shall support database connectivity mechanisms such as Java Database Connectivity (JDBC), Open Database Connectivity (ODBC) or Object Linking and Embedding Database (OLEDB)
- LADM is to be followed for cadastral database since it is being established as ISO standard. This is also adopted by SOLA software (FAO, 2011a).

All the specifications are identified from the e-Government interoperability framework and the ISO standards. Since the government have prepared the framework with the vision of making all the government data interoperable and finally integrate those data to provide information through one stop shop, LIS also need to follow those standards and specification.

4.6. Summary

The chapter discussed mainly on the results got from the case study, desk research and TEF. The study shows that the existing LIS architecture does not support the e-Government model, thus there is need of designing new LIS architecture based on e-Government. It also showed that there is serious lack of IT expert human resource in public sector which most important for the sustainability of the e-Government system.

Total sixteen requirements were identified for LIS. Those requirements were listed under technological, institutional and organizational headings. Similarly, specifications for the design were also listed under network and connectivity, application and data. Those specifications were on the basis of institutional arrangements of the government and the international standards.

5. DESIGNING LIS ARCHITECTURE

5.1. Introduction

This chapter discuss about the designing of the e-Government based LIS architecture. As discussed in research problem, business architecture is designed at first. To support the business, information and system architecture is also designed. The designing are done in UML and Microsoft Visio and based on the requirements that are identified from the previous chapter. Section 5.2 gives the details of the design in subsequent sub-sections. As an example, business workflow for ownership transfer along with access to information and field verification is shown in section 5.3.

5.2. Architecture design

Architecture identifies the components of the system and defines how they interact with each other. It is designed on the basis of needs and requirements of the users so that the system can sustain. It also provides a plan from which the product can be obtained. Three different kind of architecture are designed for e-Government based LIS. The main objective of the thesis is to design business architecture. But to support the designed business architecture, information and system architecture has also been designed. The output came from the technical requirements that have been identified in previous chapter. The technical requirement is the enacted technology according to TEF and thus the architectures are the outcome of the framework. Thus, the designing process follows the TEF.

5.2.1. Business architecture

Business architecture relates business strategy to ICT. The Business Architecture identifies the functions, process, organization, and information flow for achieving the objective of an organization. Business architecture cannot contain all the minor details of the business because of the restrictions in the modelling language but focus on the core business task and the key mechanism (Eriksson & Penker, 2000). However, it tries to clarify the complexities within the organizations and support in initiation for development of further functional applications (Versteeg & Bouwman, 2006).

On the basis of the requirement analysis, LIS business architecture is proposed (Figure 5.1) discussed in detail below. The architecture is designed on three tier concept which can be clearly seen in the system architecture in section 5.2.3. How the business process occurs is explained in section 5.3. The customers are supported through different means like counter, phone, e-mail and web service. Here the citizens are the general users and the deed writers are the professional users. If they want to have some information they can have information through any one of the stated means. However, when a deed writer needs to submit a deed, they must use the web service. Whenever the users access the web service, they are authenticated by the system. The professional users are further checked for authority of submitting the deed.

The service of LIS portal is divided into two parts as primary and secondary. The service provided by the land administration organization itself is considered as primary service and provided with support from other organization is considered as secondary service. One of the frequently occurring services is the information supply. For a single transaction, the buyer, seller, writer and internal staff may access the service for the information. Another case is the full ownership transfer when whole parcel is sold to another person. If only parts of the parcel is sold or a parcel is sold to different buyers then parcel sub division takes place. Consolidation is another task. When an owner buys the adjoining parcel then he/she may want to merge two parcels. Some people even ask for the information about the land during the first cadastral survey and the office provide with the copy of information called as field book copy. Inheritance transfer is another main task conducted by land administration organizations. Ownership is transferred from owners to their offspring. Similarly, qualities upgrading of alpha-numeric data like if somebody's spelling of the name is mistake and reported by the user then those are corrected. Also the quality of spatial data is also upgraded by field verification before any transaction takes place. Ownership certificate is the final document provided by the organization after the ownership transfer. In any case if there is a dispute in land then the organization can restrict the parcel from going for the transaction. This is also supported by court order as well. These are the task which comes under G2C model.

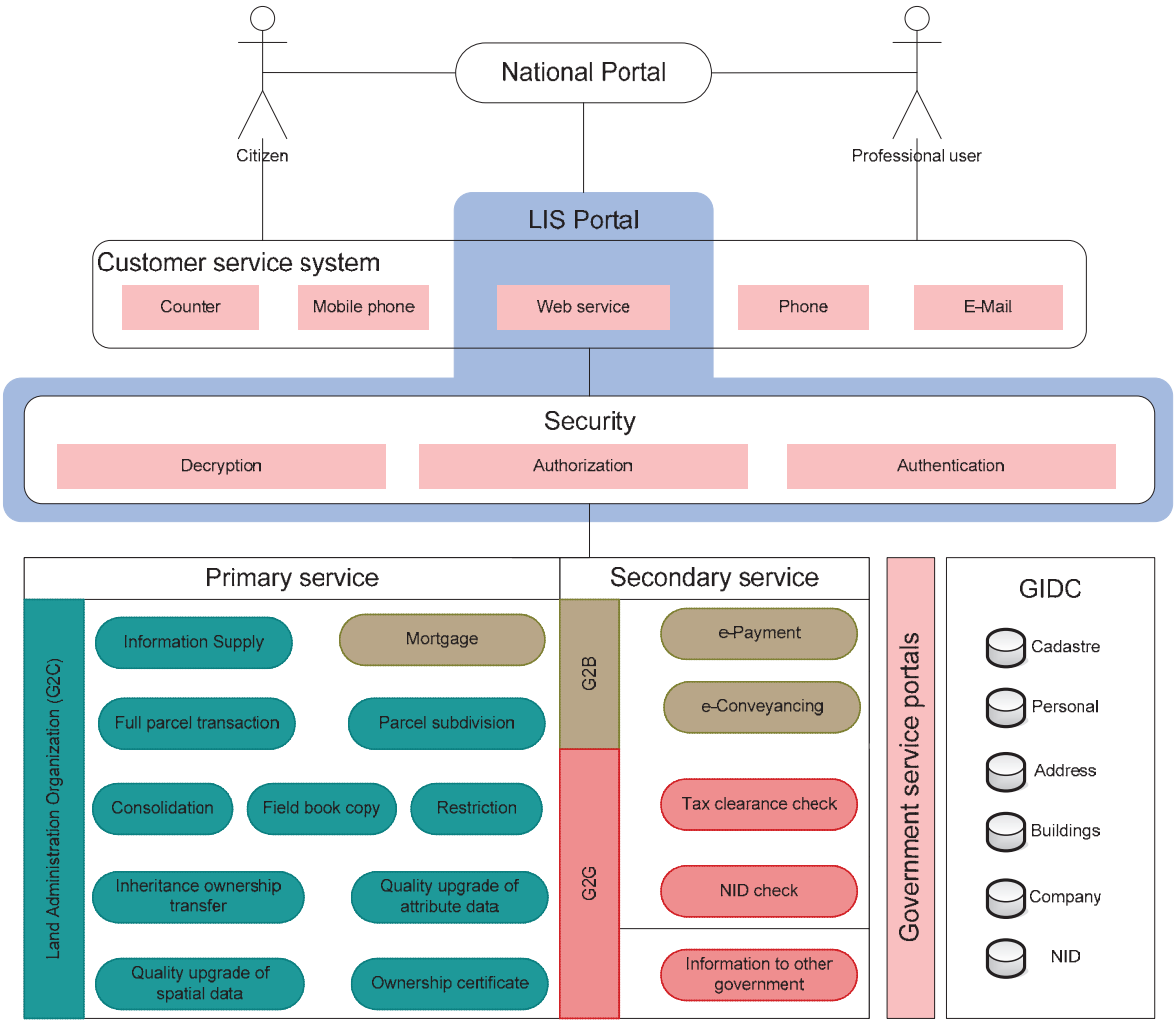

Figure 5-1: Business architecture.

Mortgage is another primary service provided with coordination with bank. If the customer put their land in mortgage for loan then the land administration organization restrict the land from transaction. Other secondary services are e-conveyancing where the deed writer can submit the electronic deed through electronic media. Similarly, facility of e-payment in LIS is another secondary service however this service is provided by external organization like banks, cooperative and finance organizations. Thus, these services are considered as G2B model. Other secondary services that come under G2G model are information supply to other government organizations, checking NID of the customers and checking clearance of the tax. Meanwhile other government may also check information from LIS. Like municipality may check the cadastral map to confirm the existence of the parcel and the related information. While asking information from other organizations, it always needs to go through the portal of respective organization since the authority of the accessing organization need to be verified. Finally, all the database are kept in the GIDC and are linked together with the integrated application system within GIDC.

This architecture covers all the three model of e-Government. Citizens can also have access to LIS or municipality through their own user ID following G2C model. Similarly, deed writer can also submit the deed electronically, update with the status of the process and getting feedback from the system thus follows the G2B model. Also, other government organization like municipality and NID also support during the land administration process which is G2G model. Further, customers can also use the e-payment system. Thus it can be said that the architecture designed is e-Government based and follows all three models of e-Government.

This architecture addresses the issues discussed earlier in chapter two like, citizen centric, technology like e-conveyancing and coordination of the actors involved (municipality and NID). The business process should follow the e-Government supporting rules and regulations like ETA/ETR for use of digital

signature which is most important in e-Government. Regarding security and quality, users cannot directly access the service portal but should access through the national portal. This portal checks the authenticity of the user with its user repository. Further, security is also maintained in every service portal. Since citizens can get information and service without visiting the office, they don't need to pay extra money to get information, writers can trace the status of the application, thus there is transparency in workflow and also the payment is done through the electronic media thus no extra money is necessary to pay. Hence there is less chance of corruption. There is always fixed cost for registration since no exaggeration is possible in electronic media.

5.2.2. Information architecture

Information architecture talks about the data used in the system and how those data are accessed. The architecture should assure that there is no redundancy in data and the databases are interoperable with each other. This is the expression of the e-Government system in terms of database that is being used in the system. It is the design of the data stored by the information systems and their interrelationships. The information architecture proposed here supports for the e-Government system (Figure 5.2).

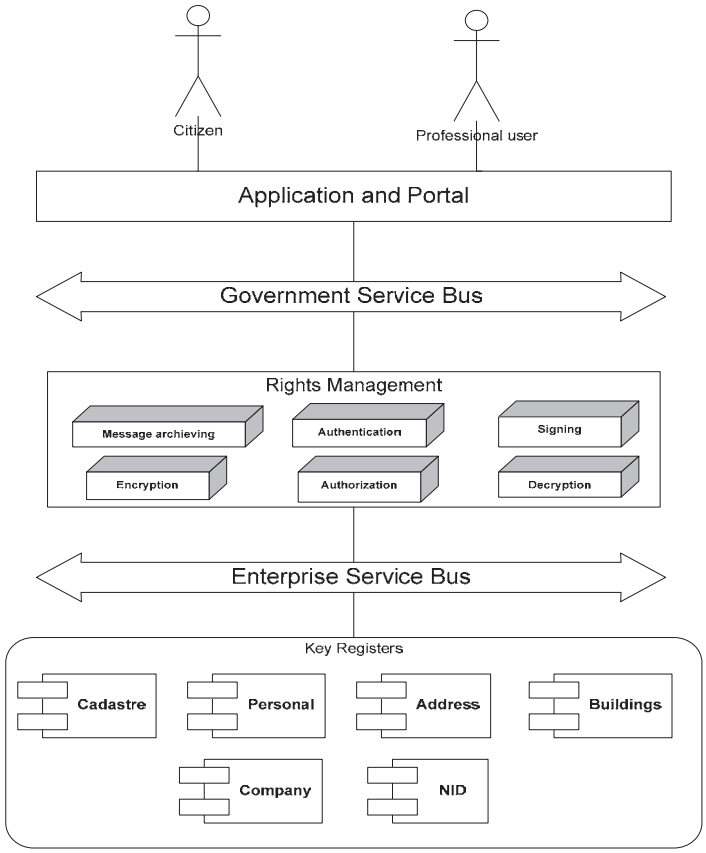

Figure 5-2: Information architecture with key registers.

Concept of key register is proposed for the database as discussed in section 4.5.1.2. To assign the key register, the decision makers need to have clear vision about the key register and its advantages. Assigning of key register for the database helps in reducing the redundancy and decrease errors in database. No other organizations can produce the same kind of data and thus use the same key register. If the users find errors, then they can inform the government and thus the errors can be reduced. For the case of Nepal, six key register are proposed at this stage. The database are cadastre, address, buildings, personal, NID and company register. The databases are of different organizations. Like cadastre is handled by department under MOLRM, address and personal are owned by the municipality under Ministry of Local Development, NID is owned by district administration offices under Ministry of Defense and company register is handled by Ministry of Industry and Commerce. At present, buildings are mapped in the cadastral maps and different municipalities are also preparing their own building database thus creating redundancy and inconsistency in the database. Thus, it is proposed that the building is to be handled by

the municipality itself only. The ownership of the data is the municipality and stored as the key register. The data acquisition can be done by any other party but it also could be overlaid in cadastral maps.

The databases are always accessed through the national portal by the citizens and the professional users. National call centre is also proposed to provide information about the system and available service. This helps for the people and places where there is no easy access to the internet. The government organization can either access through government portal or respective web service portal. Provision of e-payment gateway is proposed through the respective web service portal.

With the concept of integrating all the database in one single location, it is proposed to keep all the database in the GIDC which is established with this purpose. This concept is in line with the issue of e-Government i.e. security and database discussed in previous chapter. Hosting of all databases in one center makes easy to link and reduce redundancy which is supported by the concept of key register. Also, since all the database are stored in the single center, it will be easier to check the security in one single center rather than number of departments. Also provision of encryption, decryption and authorization are also proposed with the concept of security of the database and the system. However, there is also the risk to all databases one at a time. So security of the system needs to be seriously handled.

5.2.3. System architecture

System architecture describes the broader concept of the system. It is the kind of conceptual model that shows the structure and behavior of the system. It gives the integral technical overview of the system. It is also considered as a set of rules that defines the structure of the system. Here the rules are the policy, rules and regulations. System architecture helps in streamlining business process and also identify necessary IT infrastructure. The designed architecture is LI system architecture. The architecture is designed on the basis of the requirements identified earlier and the existing rules, regulations and guidelines. The existing LIS is not an e-Government system but the isolated digital system established in individual district offices. The designed architecture connects all the district offices to the centre office and the GIDC which is established for the integration of government database (Figure 5.3).

The architecture is designed with the concept of web based application for land information and three tier client server concept. The databases are stored by the GIDC and the applications are maintained by the department. As a backup of this database, copy of it is also kept in central department. All the district offices access through the application at the central department. Thus, they access the database that is stored in database server at GIDC using the land information web service provided by application server at department updating the database directly in GIDC. The connectivity of the district offices, department and with GIDC are also proposed. This connectivity is according to the Nepal GEA guidelines and NeGIF. However, this connectivity is only for the initial stage and needs to increase in future when all the district offices are digitalized. Along with this, concept of disaster recovery site for whole GIDC has also been initiated and feasibility study for this has been started.

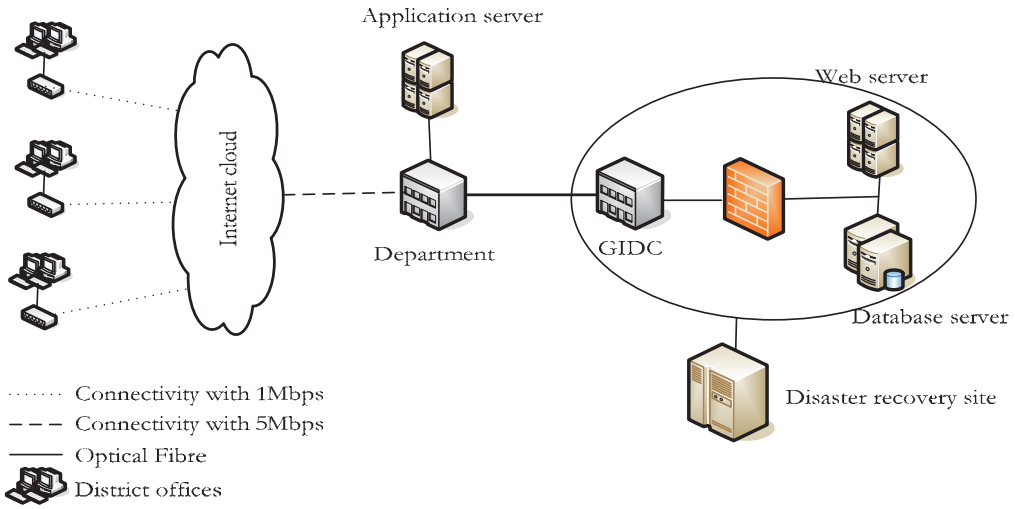

Figure 5-3: System architecture.

5.3. Business workflow

Since business, information and system architecture are designed, an example of ownership transfer is considered to show the business workflow. The workflow is discussed in three parts. At first, users checks information about the land that is going under transaction. Second, field verification is done for the concerned parcel. Then in third step, deed is lodged which are discussed in different sub-sections. It is also proposed that, those who have got NID can get one user ID by registering on national portal to get access to every e-Government service of the government. Here, the customers are the citizens (general users) and deed writers and private surveyors are the professional users. Customers have only access to view the information and request for the products and services. Professional users provide documents with the information to do the business and update the LIS data. Digital signature is necessary for the electronic transaction. Provision of digital signature is supported by ETA, 2008. According to ETA, Government of Nepal can designate Controller by notification in Nepal gazette to issue a license to the certifying authority that provides the digital signature certificate. Private Key is used to create digital signature and public key is used to verify the signature. Also, e-payment is a service provided by external institute like banks, cooperative organizations or e-payment gateway like www.esewa.com.np. For this kind of service terms of conditions need to be presented to the customer beforehand and they should agree those terms and condition to have e-payment service.

5.3.1. Business workflow for information access

For single transaction information are accessed for number of times. Buyer may check the information. Deed writer may check the information. Similarly, private surveyor may check the present status of the parcel and also the internal staff also checks the information if those information provided by the deed writer are correct or not. The workflow is shown in figure 5.4.

1. The users log in through the national portal. Through this portal, they choose the service (LIS) of their choice.
2. National portal authenticates the user through user repository. If the users are not valid, error message is sent and if valid then log in through the portal.
3. Professional users are further checked for authorization. Certifying authority checks the authority of the professional users and if they are not authorized then error message is sent and if authorized then allowed to log in through the portal.
4. Then after the user come to the page where different e-Government services are available. Users choose the LIS portal.
5. Then after the user search for the required information. The portal shows the information along with the charge for it.
6. The users pay the charged amount through the e-payment gateway. The gateway is the service provided by the external organizations.
7. As the payment is complete, users are provided with the information.

Internal users of the organizations (administrative and surveyor) also access the information. Their authenticity is also checked. However, they have also the right to edit the database (add, update, delete) along with right to read but they don't need to pay.

5.3.2. Business workflow for field verification

Compulsory field survey before any transaction takes place is proposed for this system. This brings about the decrease in land dispute and also support in quality upgrading of the spatial data. At first, buyer and seller make a deal for the transaction and request for the field verification by the surveyor. Surveyor goes to the field and measures the dimensions. The survey can be either sporadic or systematic. During survey, technology like GPS, Total station or even satellite image can be used. The surveyor then prepares preliminary parcel plan and area calculation is done. The same area is used in the deed. Detail is shown in figure 5.5.

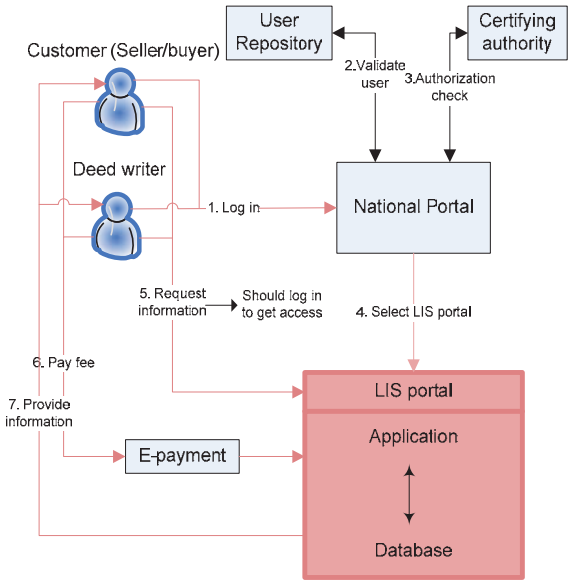

Figure 5-4: Business workflow for information access.

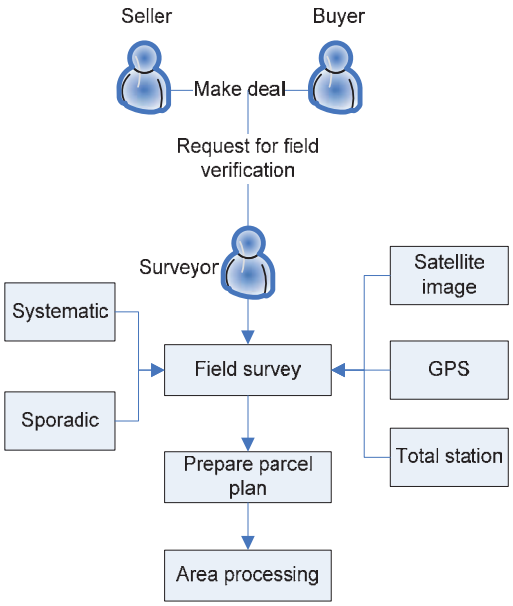

Figure 5-5: Business workflow for field verification.

5.3.3. Business workflow for land transaction

After finishing the field verification, preparation of deed and submission takes place. For this, the seller needs to clear the tax for the running fiscal year. Detail process is shown in figure 5.6.

1. Step 1, 2, 6 and 7 are same as discussed in section 5.3.1
3. The municipality portal provide with the amount that is to be paid by the seller (owner) as the land tax.
4. User (seller) then pays the tax through the e-payment system available in the municipality portal. The taxes are paid at the start of every fiscal year. Thus, if the transaction takes place at the middle or some other date after the start of fiscal year, the buyer does not need to pay tax for that fiscal year and start paying from coming fiscal year.
5. The municipality portal sends the acknowledgement of the tax payment with details.

Then after, the customer along with the buyer visit deed writer and the writer prepare deed according to the consent between buyer and seller.

8. Then the writer submits the deed through the LIS portal. Information of deed is converted to XML file and handled by application in the portal.
9. Acknowledgement of registration is sent to the writer along with the registration number if the deed is complete or else message of rejection is sent.
10. Internal staff of the land administration office logs in through the LIS portal and checks the application. The staff checks the provided information with the database. If the information is not complete and not correct, error message is sent.
11. Here also before providing the access, the LIS portal checks for the authenticity of the staff with the certifying authority, if the staff is still authoritative or not. If he/she is not authorized then the error message is sent back.
12. If the information is correct and complete, then the NID of the buyer/seller is checked in NID portal through integrated application system.

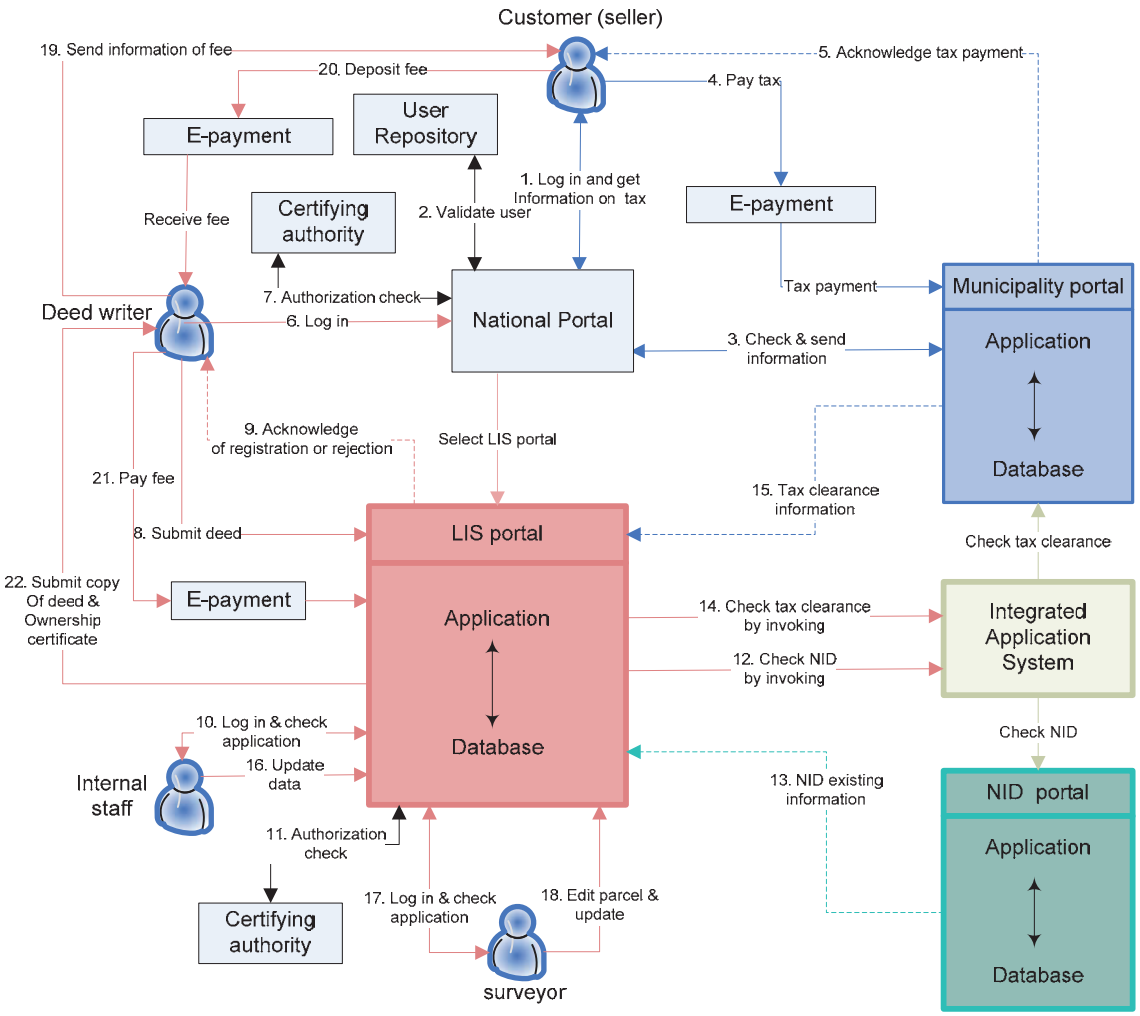

Figure 5-6: Business process for land transaction.

13. NID portal inform about the existence of the NID. If NID does not exist then error message is sent to the writer by LIS portal.
14. Then the tax payment status with municipality portal is checked through the integrated application system.
15. Municipality portal inform about the status of the tax either paid or not paid. If no tax payment then the error message is sent to the writer by LIS portal.
16. If everything by now is correct then the staff updates the alpha numeric database.
17. Surveyor log in through the LIS portal and checks the application. Surveyor also checks the information of the deed with the information available in the database. The LIS portal checks for the authenticity of the surveyor with the certifying authority, if the surveyor is still authoritative or not. If he/she is not authorized then the error message is sent back.
18. Then the surveyor edits the parcel and updates the database according to the parcel plan prepared earlier during field verification.
19. During the time deed writer regularly checks on the status of the application. When everything is finished and payment status appears, writer informs the customer with the amount.
20. The customer deposits the required amount for the transaction through the e-payment system.

21. Then the writer pays the fees through the e-payment system of the LIS portal.

22. The LIS portal provides the ownership certificate to the writer after payment is clear.

Here, the sequence of steps can be different in different cases. Like for example, if both buyer and seller agree on the information about the land during full ownership transfer, then they can go to writer before field verification by surveyor. After completion all the steps discussed above, then the financial matters (payment of the land) between buyer and seller occurs in presence of the deed writer.

5.4. Validation of the architecture

Limited validation is done for the designed architecture. External validation is done by the discussion with the expert from Kadaster of the Netherlands. The architecture was discussed with the System Architect of the Kadaster for the validation. This was also supported by the case of Netherlands cadastre. Successful architecture of Dutch cadastral system was studied to get the knowledge about the architectures for LIS. Another validation is the workflow discussed in earlier sections as an example which is considered as an internal validation. The workflow is proposed on the basis of designed architecture. It is discussed in three aspects as access to information, field verification and land transactions. These workflows follows the architecture designed and also all the three models of e-Government.

5.5. Summary

The chapter was focussed on designing the business, information and system architecture of land information based on e-Government. It was seen that the designed architecture follow all three models of e-Government and also the e-payment system was also included. Concept of key register was also proposed which help in managing the database and their interoperability. For this preliminary stage, cadastre, personal, buildings, address, NID and company register are proposed for assigning key register. More databases can be assigned as key register in future according to the requirements. It was also concluded that for e-Government system, development of LIS only is not enough but also the related organization. Like in this case, municipality as well as NID also needs to have e-Government based system. Further, the designed architecture also took care about the e-Government issues discussed earlier like citizen centric, web based technology, non redundant and interoperable data, network with supporting actors, security and quality. The business workflow discussed shows how the e-government based LIS architecture designed performs the task and where different actors are involved. Also, since the electronic payment system is introduced, there is less probability of corruption as fixed amount is paid through online media. Continuous tracking of the flow of electronic document within the organization's workflow shows the transparency in the workflow as well.

6. RISK ANALYSIS AND PLAN OF IMPLEMENTATION

6.1. Introduction

The chapter discuss about the risk of the implementation of designed architecture and the indicative implementation plan. We have seen that most of the e-Government system failure cases in the world for different reasons as discussed in chapter two. Thus, in this study also analysis of probable risk in implementation of the designed system has been done. Risk analysis followed by indicative implementation plan is discussed in successive sections below.

6.2. Risk analysis

Discussions from earlier chapters show that different factors play role in success or failure of the e-Government system. Buhl and Löffler (2011) identified the lack of IT experts in government organizations as the severe problem for the implementation of e-Government. On the other hand, Chen (2010) focuses on the necessity of technical capacity of organizations as governments adopt information systems to provide integrated service. As we see that there is involvement of other organizations as well along with land administration organizations. So, there may also exist problem in cooperation and coordination. Risk analysis is the identification of the risk, its impacts and recommendations for reducing risk. Thus, this should also be one of the parts of system development life cycle such that the output of the analysis can be used to identify the control measures to reduce or eliminate risk. Thus, risk analysis is done in this study as well to identify the probable risk in implementing the designed architecture based system. However, the analysis is only the subjective analysis and is based on the personal experience and own judgment of the researcher.

In most system development projects risk log frame is prepared to identify risk and recommendation to reduce the risk. Same is done for the risk analysis in this research. The log frame consists of the risk description, risk impact, risk probability, priority, strategy to minimize risk and status for risk mitigation measures. The potential impact of each risk is represented with appropriate impact level. The range is determined from 1 to 3 (Table 6.1). As said earlier, the values are determined on the basis of experience and personal judgment.

Table 6.1: Risk impact values.

Category	Value	Description
Low	1	Insignificant or minor impact
Medium	2	Major impact
High	3	Prevent implementation

Risk probability is the likelihood of the occurrence of the risk. Since the probability ranges from 0 to 1 but cannot be said that it case is 100% probable or does not occur, for this analysis, impact probability value is determined as stated in table 6.2.

Table 6.2: Risk probability value.

Category	Value	Description
Very high	0.9	Risk expected
High	0.7	More likely to occur than not occur
Medium	0.5	May or may not occur
Low	0.3	Less likely to occur than not occur
Very low	0.1	Not expected to occur

Then the impact score is calculated as the product of impact and probability. On the basis of this score, priority of the risk to be handled first is determined. If the value is less than 1, then low priority, if is from

1 to 2 then medium and if the value is greater than 2 then high priority is assigned. Decision or strategy in risk analyses defines the action to be taken for the risk identified. Different decisions like prevention, transfer, reduction and accept are introduced.

Prevention sometimes may even need to ease the objective or redefine and clarify the requirements. Transfer simply means transferring the response to other actors but does not eliminate the risk. Reduction means to reduce the probability of occurring risk to the acceptable level. Accept means to accept the risk that may occur. Acceptance of the risk can only be done to low priority risks. Status in risk log helps in monitoring the risk management. Different status could be identified, complete analysis, complete planning and resolved. Detail analysis and log frame is show in table 6.3.

Table 6.3: Risk log.

Risk ID	Description	Impact	Probability	Score	Priority	Decision /strategy	Status
1.	Reluctant government	3	0.9	2.7	H	R	I
2.	Passive leadership	3	0.7	2.1	H	R	I
3.	Insufficient legal framework	3	0.7	2.1	H	P	I
4.	Lack of long term vision & strategy	3	0.7	2.1	H	R	I
5.	Lack of skilled human resource	3	0.7	2.1	H	P	I
6.	Failing implementation of acts/rules	2	0.9	1.8	M	P	I
7.	Lack of sufficient infrastructure	3	0.5	1.5	M	R	I
8.	Insufficient budget	3	0.5	1.5	M	R	I
9.	Readiness of organization (staff)	3	0.5	1.5	M	P	I
10.	Poor designing	3	0.5	1.5	M	R	I
11.	Lack of coordination	2	0.7	1.4	M	R/T	I
12.	Organizational inflexibility	2	0.7	1.4	M	R	I
13.	Digital divide	2	0.7	1.4	M	R	I
14.	Inconsistency in the database	2	0.7	1.4	M	R	I
15.	Confusion in liability	2	0.7	1.4	M	R/T	I
16.	Lack of continuous maintenance	2	0.5	1	M	R	I
17.	Readiness of citizen	2	0.3	0.6	L	R	I
18.	Lack of trust in the system	1	0.5	0.5	L	R	I
19.	Migration existing data	1	0.3	0.3	L	A	I

Priority: H=High, M=Medium, L=Low
Decision: P=Prevention, T=Transfer, R=Reduction, A=Accept
Status: I: Identified, A=Analysis complete, P=Planning complete, R=Resolved

Total nineteen risks has been identified and analyzed accordingly. The risks were identified from interview and the literature studies. It was seen that the reluctant government was the most probable risk in the case of Nepal, followed by passive leadership, lack of legal framework and lack of vision and strategy with highest impact scores. Similarly, lack of trust in the system and migration of existing data were identified as less probable risk with least scores. This shows that there is necessity of strong determination and will in the politicians and the managers at the apex body need to be strong in IT knowledge. Without sufficient legal framework, strategy and vision, no system can step forward. But there is lack of these necessary things in case of Nepal. Thus, the risks identified should either be eliminated or reduced for the successful implementation of the system. Further, in the status, all the risk were stated as 'identified' since this thesis does not go for implementation and thus other status cannot be stated. Other status like analysis, planning and resolution are kept only when the risk triggered and further actions are taken on those risks during implementation.

6.3. Indicative implementation plan

The systems are designed to get better and efficient services and that can be achieved only if the developed systems are implemented. While implementing, the inhibiting factors discussed as failure factor in earlier chapter need to be considered. Weerakkody *et al.* (2012) also conclude that the political, fiscal,

organizational and institutional issues need to be addressed while deploying the e-Government system. In this thesis also, an indicative implementation plan has been prepared for the proposed LIS. The plan has been discussed as short term, medium and long term plan in table 6.3, 6.4 and 6.5 respectively. The time frame is starting from the date of implementation of the system. Same as the risk analysis, the plan is also prepared on the basis of experience and personal judgment. Thus, this is stated only as indicative implementation plan.

Table 6.4: Short term implementation plan.

S. No.	Description	Responsible agency	Supporting agency	Tentative time
1.	Assign one responsible apex agency to coordinate e-Government system	Nepal Government	OPMCM	3 months
2.	Prepare e-Government policy and strategy	Apex agency	MoLJ	6 months
3.	Address IT service group in public service	Nepal Government	MoGA, PSC	6 months
4.	Prepare e-Government implementation directive	Line ministries	Apex agency	6 months
5.	Assign nodal officer in every offices	Respective agency	Respective ministry	3 months
6.	Implement digital signature	Nepal government, apex agency	Line ministries	1 year
7.	Develop application system	Line ministry	GIDC	1 year
8.	Reorganization of land administration offices	MoLRM	MoGA, MoF	1 year
9.	Assign key registers	Nepal Government	Respective ministries	1 year

Table 6.5: Medium term implementation plan.

S. No.	Description	Responsible agency	Supporting agency	Tentative time
1.	Establish internet and intranet within district offices and with department in high transaction occurring offices	District offices	MoLRM, DOLIA	2 years
2.	Digitize all spatial data and data migration of attribute data to new system	District office	DoLIA	2 years
3.	Develop integrated system in GIDC	GIDC	Line ministries, apex agency	2 years
4.	Transfer all administrative staff into IT staff	MoLRM	MoGA	Continue
5.	Introduce e-payment system	MoLRM	MoF, Banks	2 years
6.	Start electronic transaction	District offices	DOLIA	2 years

Table 6.6: Long term implementation plan.

S. No.	Description	Responsible agency	Supporting agency	Tentative time
1.	Provide technical accessories and establish internet and intranet in remaining offices	District offices	MoLRM, DOLIA	4 years
2.	Establish at least one telecenter in each VDC	Apex agency	MoF	3 years
3.	Transfer all administrative staff into IT staff	MoLRM	MoGA	Continue

4.	Establish government portal in GIDC	GIDC	MoF, ministries	Line	3 years
5.	Link database with other government agencies	Respective ministry	GIDC, ministries	line	4 years
6.	Train deed writers and start e-conveyancing	District offices	DOLIA		4 years

The implementation plan is prepared on the basis of assumption that there is sufficient amount of budget and in the presence of active government and leadership. Continuous monitoring is necessary for the successful completion of system within the time frame.

6.4. Summary

The chapter discussed about different risks that may arise during the implementation of the LIS in the future. Total of nineteen different risks were identified. From this analysis it is seen that the most probable risk is from the passive government and the leadership. Reluctant government, passive leadership, lack of legal framework and lack of skilled human resources were identified as the most effective risks and thus categorized under high priority. Similarly, lack of trust in system and the migration of existing data are identified as the least effective risks and thus categorized as low priority. The risks categorized as high and medium priority needs to be prevented or reduced during the implementation of the system. The status of 'identified' is kept for all the risks.

Similarly, tentative implementation plan of the system is also prepared for the system. The plan helps in monitoring the progress during the implementation of the system. The plan covered the themes of legal, technological, organizational and human recourses. The estimated times are from the time of the start of implementation. The time within 1 year is kept as short term plan and more than one to two years are kept as medium term plan. Similarly, time required more than 2 years are kept as long term plan.

7. CONCLUSION AND RECOMMENDATION

7.1. Introduction

This chapter discuss about the conclusions drawn from the research. Section 7.2 draws the answers to the questions fulfilling the objectives and section 7.3 discuss about the recommendations for future research.

7.2. Conclusion

The research identified the necessity of use of ICT in the field of land administration services to provide better, efficient and transparent services. Many failure examples as discussed in section 2.2.2 have also made the world alert about the necessity of addressing different e-Government related issues for the successful implementation of the system. Thus, the research came up with different architectures for the land information system with due consideration of the issues identified in section 2.2.1 and requirements found out in section 4.5.1.

The major objective was to design business architecture for land administration in support to e-Government on the basis of user's requirements. For this, the case of Nepal was taken to study. Interviews were conducted with the key respondents which were identified according to the actors defined by TEF, the framework which has been followed to conduct this research. From the interview, requirements were identified and categorized as technological, organizational and institutional requirements. In total sixteen requirements identified, the requirements of citizens were adopted from previous research done ITC. On the basis of the requirements, a business architecture was designed and to support this business architecture, information and system architecture were also designed which is discussed in detail in chapter five. The business architecture showed a process of accessing services and products and different services and products provided by the land administration organizations. Web portal is the media to get the transaction services of LIS. Also, other different organizations are also linked with LIS to provide electronic service and reduce the data redundancy. The architecture also showed that all the key registers proposed are also stored in single data centre to support data sharing and linking. According to this proposed architecture, professional users can submit the electronic documents, citizens can access the information through online and also land administration organization can access other governmental data easily through electronic media. Thus, it can be concluded that the designed architecture support all three environment of e-Government.

The research also includes the study about the existing architecture of the Dutch cadastral system. One of the system architects from the Kadaster was interviewed to get the necessary information about the LIS and architecture within Kadaster. During a discussion, the designed architecture was validated by the system architect (based on comparison with the architecture of the Dutch Kadaster and based on expert review). From the designed architecture and the discussions made earlier in first and second chapter of thesis, it can be concluded that the architecture brings efficiency in service delivery, reduces corruption, increases access to information and improve data quality.

Conclusions are presented according to the research objectives and discussed in detail on the basis of research questions that stated in chapter one. The main objective of this research was to design business architecture for a land information system based on e-Government which is already achieved as discussed in chapter five. However, to support in achieving this objective, two sub-objectives are defined. Thus, the result came up with following conclusions for each research questions as discussed below.

1st sub-objective: To minimize the discrepancies between e-Government policy and land information system.

1. *What are the land-information related elements required in LIS according to user's requirement?*

Different elements are necessary in LIS for the better service delivery. As discussed in chapter two, *policy, rules and regulations* is one of the most important elements. Policy, rules and regulations are the basic supporting documents to provide the service. Different *directives* to support the service delivery are also necessary elements. ETA and ETR are already formulated in Nepal. But these legal documents are the general document for all electronic transactions that occur government and its environment. Thus,

following these documents, LIS specific directives need to be prepared. This policy and regulations supports other elements like *biometric data* which is most required in case of LIS. LIS is about a people and their relation to land. So even they cannot write, they can use finger prints. Another element is the *digital signature* which is important for electronic conveyancing. Without the provision of digital signature a deed cannot be lodged electronically. A *digital database* is another most important element for LIS. In contrast to other databases, a LIS consist of spatial data along with attribute data. Similarly, *IT infrastructure* is another important element in LIS. It includes from desktop computer to all required accessories, software, networks, internet, and intranet etcetera.

e-Payment is also a requirement in LIS in the case of Nepal. This helps in reducing corruption since fixed amount is paid online and there is no possibility of exaggeration. *e-Conveyancing* is another element necessary in LIS. Professional users can submit the deed electronically. These two elements follow the G2B model of e-Government. Similarly, *data sharing and linking* is another requirement of LIS supporting e-Government to follow the model of G2G. *LIS portal* is another element required that support in providing online services to the users which follows G2C model of e-Government.

2. What are the land-information related elements in e-Government policy?

e-Government policy is the broader document which covers all the government function relating to e-Government including LIS. The first element required is the *avoidance of data duplication*. The concept of key register is important to reduce duplication in hand written registers and databases. For example, if land related data is assigned as key register then no other organization can produce the same data again thus reducing duplication of task, improving quality of data and saving unnecessary expenses. Another element in the policy is the *interoperability framework* that will help in linking and sharing between the databases of key registers. As all the key registers follow this framework then they can be easily linked with each other. This will support environments of e-Government. Sharing of data contents of databases of government organizations supports G2G concept. Also the business organizations, professional users and citizens can get information from the shared database from a 'one stop shop' supporting G2B and G2C concepts of e-Government. Beside this, *database* is another requirement that need to be addressed by e-Government policy. To support sharing and linking of all the key registers, it will be easier if they can be stored in one single place, the datacenter. This helps to manage another crucial issue i.e. the *security* of the database. Since all the databases are held in one single centre, management of security will be easier than distributed databases.

Another most necessary element is the *national portal*. This is the only portal from which the users can get access to other service portals. Also, get access through this portal then the users need to have unique *user ID* which is another necessary element to be addressed by e-Government policy. *Integration of data* is another requirement need to be addressed in policy that is to be done within GIDC.

3. How to align elements of LIS into e-Government policy?

Since LIS is meant to provide electronic service to the citizens, it is necessary to align the issues and elements of LIS to the e-Government policy. This can be done by different steps like assigning cadastral information as one of the key registers. Then, the LIS and the database used in the system must be prepared according to the interoperability framework. As it follows the framework then it can be linked with the other databases which are associated with land information like municipality data and NID data governed by other government organizations. Then the database can be stored in one central datacenter i.e. GIDC. Here, all other key registers are also stored. As stated above, biometric data is another important element in LIS. Regarding this, e-Government policy should be flexible while addressing about digital signature which is discussed by ETA/ETR. Biometric data are not addressed by ETA/ETR. Since most of the unlearned citizens use their thumb print, e-Government policy should address biometric data along with the use of digital signature. Further, since all the services are accessed through the national portal, LIS portal also need to be included within this portal. Thus, it can be seen that aligning of LIS into e-Government policy is more concentrated in legal aspects of sharing and linking database, security, quality, access and liability of the database. This requires allocation of responsibilities and tasks within governmental organizations, ownership of data, copyright, liability, privacy, security and quality of data.

2nd sub-objective: To design business architecture and supportive information and system architecture.

4. What are the requirements of LIS in terms of institutional, organizational and technological aspects?

This research identified total sixteen requirements and was categorized under technical, institutional and organizational requirements which are discussed in detail in chapter four. Adherence to NeGIF and GEA, web based system, provision of e-payment system, use of NID, integrated LIS, data security and quality and internet facility are identified as technical requirements. Since NeGIF and GEA are already formulated, the developed system should in comply with those frameworks to be incompatible with other government databases. Web based systems helps in easy access to information by the citizens. e-Payment service is provided with the support from banks or other financial organizations. If everything in the system is electronic and the user needs to visit banks for the payment then that is incomplete e-Government. Integrated LIS is another important requirements identified. At present different system are being implemented for land registration and survey. This is creating problem in coordination and also inconsistencies between two databases.

Policy, rules and regulations, electronic service, directives for e-services and key register are identified as institutional requirement. Nepal still lacks e-Government policy. ETA/ETR are already prepared but not implemented. Thus, the policy and directive with relation to the service is identified as the institutional requirement. Another requirement identified is the concept of key register. This will help in reducing redundancy and errors in the database.

Similarly, integration of organizations, integration of data into GIDC, IT manpower and upgrading IT knowledge and IT service management are identified as organizational requirements. There are two offices working for the same land administration under the same ministry at district lever. This creates problem in coordination and also increase corruption. Thus the integration of the organization will support in overcoming those kinds of problems. Further, for the sustainability of the system, human resources with IT knowledge are necessary. Besides this, service management is also necessary for the sustainability of the system. Management of different fields like service delivery, service support and infrastructure management is most crucial sector (Appendix D).

5. How to design LIS business architecture?

The base for the business architecture is the requirements got from the respondents. This follows the TEF. The technical requirements identified from the interview with respondents from high level government officials act as the enacted technology and are used to design the architecture. Microsoft Visio/UML was used to visualize the architecture which is clearly discussed in chapter five. The business architecture shows different components like access of the users to the system, security check of the users, different services provided by the land administration organization and the location or the storage of the all key registers which have been proposed. The three models of e-Government are also clearly defined in the architecture proving that the designed architecture is e-Government based. To support this business architecture, related information and system architecture is also developed. Information architecture shows how the users access to the service portals, how their rights to use and access the service are managed and how the access to the database is authorized. In broad and organizational level, the system architecture discusses about the location of organization, different servers and database. The system architecture is designed in three tier client server concept. District organizations are the clients. The application server is situated in the central department and the web server and database server are kept in GIDC. The client uses the computer with simple internet access and use the application through the department. This server accesses the database at the GIDC.

6. How to validate designed architecture?

Validation in the real field is only possible when the system is designed and implemented. This may take several years thus to validate as well. However, limited validation for the academic purpose has been done by the system architecture of the Kadaster of the Netherlands. This is the external validation and was also supported by the study of Dutch LIS architecture. Internal validation is based on different workflows prepared as in chapter five. Workflow for different task like access to information, field verification and

land transaction are prepared. From the architecture and the workflow, it can be seen that the architecture adopts all three models of e-Government. Further, risk analysis and the implementation plan are also prepared in this research as discussed in chapter six. The analysis and the plan are subjective and are based on personal experience and judgment. The implementation plan has been prepared from the initial stage of the system development.

7.3. Recommendation

On the basis of the user's requirement, the business architecture and the supportive information and system architecture has been developed. Still all the issues have not been addressed in this research. Thus following research in the field of e-Government for the future studies has been recommended.

- Nepal is going under governmental restructuring. It has already been changed from kingdom to Federal government. However, finalizations of the structure of government, including number of states are still not finalized. The LIS architecture designed is based on central government. Thus it is recommended to study about how it should be in federal government in future.
- The key registers here are only proposal to get assigned. From the study, it was found that at this stage six key registers are sufficient. Thus it is also recommended for the study that if these six proposed key registers is sufficient to cover the needs or not.
- Since digitization of attribute and spatial are not done together, there exists problem of inconsistency between two database which brings problems while integrating them. Thus the study on probable errors during integration and the possibilities of continuous upgrading of the quality of the spatial and attribute data through this kind of system is also recommended.
- The architecture proposed by this research is a conceptual architecture. So, there is lot more detail information necessary to adopt this kind of system. Like for example, what could be the detail technological specifications like capacity of servers, configuration of computers, speed of connectivity according to the access etcetera, what could be the financial requirements and so on. Thus, it is recommended to do the study on in depth analysis of requirements on the basis of the designed architecture.

LIST OF REFERENCES

Ahmed, M. (2002). *Electronic Birth Registation in Rajshahi, Bangladesh*. Last visited http://www.egov4dev.org/success/case/ on 7th December, 2011.

Ahn, M. J. & Bretschneider, S. (2011). Politics of e-Government: e-Government and the Political Control of Bureaucracy. *Public Administration Review, 71*(3), 414-424.

Akther, M. S., Onishi, T. & Kidokoro, T. (2007). e-Government in a Developing Country: Citizen-centric Approach for Success. *International Journal of Electronic Governance, 1*(1), 38-51.

Al Nagi, E. & Hamdan, M. (2009). Computerization and e-Government Implementation in Jordan: Challenges, Obstacles and Successes. *Government Information Quarterly, 26*(4), 577-583.

Alanezi, M. A., Kamil, A. & Basri, S. (2010). A Proposed Instrument Dimensions for Measuring e-Government Service Quality. *International Journal of u and e- Service, 3*(4), 1-17.

Aldrich, D., Bertot, J. C. & McClure, C. R. (2002). e-Government: Initiatives, Developments and Issues. *Government Information Quarterly, 19*(4), 349-355.

Andersen, T. B. (2009). e-Government as an Anti-corruption Strategy. *Information Economics and Policy, 21*(3), 201-210.

Basu, S. (2004). e-Government and Developing Countries: An Overview. *International Review of Law Computers and Technology, 18*(1), 109-132.

Bayens, G. (2006). *e-Government in the Netherlands*. Last visited www.via-nova-architectura.org on 16th October, 2011.

Bekkers, V. & Homburg, V. (2007). The Myths of e-Government: Looking Beyond the Assumptions of a New and Better Government. *Information Society, 23*(5), 373-382.

Bermudez, J. R. R. (2007). *e-Government City Models: Cases from European Cities*. Barcelona City Council.

Bernus, P. & Schmidt, G. (2006). Architectures of Information Systems. In P. Bernus, K. Mertins & G. Schmidt (Eds.), *Handbook on Architectures of Information Systems*, 1-9: Springer Berlin Heidelberg.

Bhuiyan, S. H. (2011). Modernizing Bangladesh Public Administration Through e-Governance: Benefits and Challenges. *Government Information Quarterly, 28*(1), 54-65.

Boersma, K., Meijer, A. & Wagenaar, P. (2009). Unraveling and Understanding the e-Government Hype. In K. Boersma, A. Meijer & P. Wagenaar (Eds.), *ICTs, Citizens and Governance: After the Hype!*, 256-265: IOS Press.

Brancheau, J. C., Schuster, L. & March, S. T. (1989). Building and Implementing an Information Architecture. *Data Base, 20*(2), 9-17.

Buhl, H. & Löffler, M. (2011). *The Role of Business and Information Systems Engineering in e-Government. Business & Information Systems Engineering*. Last visited http://dx.doi.org/10.1007/s12599-011-0182-4 on 21st Nov, 2011.

Cavaye, A. L. M. (1996). Case Study Research: A Multi-faceted Research Approach for IS. *Information Systems Journal, 6*(3), 227-242.

Chawla, R. & Bhatnagar, S. (2004). *Online Delivery of Land Titles to Rural Farmers in Karnataka, India*. Paper presented at the Scaling Up Poverty Reduction: A Global Learning Process and Conference., Shanghai, China, May, 25-27, 2004.

Chen, Y. C. (2010). Citizen-Centric e-Government Services: Understanding Integrated Citizen Service Information Systems. *Social Science Computer Review, 28*(4), 427-442.

Cordella, A. & Iannacci, F. (2010). Information Systems in the Public Sector: The e-Government Enactment Framework. *The Journal of Strategic Information Systems, 19*(1), 52-66.

Danziger, J. N. (2004). Innovation in Innovation? The Technology Enactment Framework. *Social Science Computer Review, 22*(1), 100-110.

De', R. & Sarkar, S. (2010). Rituals in e-Government Implementation: An Analysis of Failure. In M. A. Wimmer, J. L. Chappelet, M. Janssen & H. J. Scholl (Eds.), *Electronic Government*, (Vol. 6228), 226-237.

De', R. & Sen, C. (2004). The Complex Nature of e-Government Projects: A case Study of Bhoomi, an Initiative in Karnataka, India. In R. Traunmuller (Ed.), *Electronic Government, Proceedings*, (Vol. 3183), 556-557.

DFA. (2006). *e-Government Strategy*. Department of Finance and Administration, Australian Government.

Dhal, N. (2002). Land Information System (LIS)-A Cae Study in Orissa. *Indian Cartographer, 02*, 295-298.

Dijkstra, T. & Booij, m. A. S. (2003). *Renewal of Automated zInformation Systems as the Netherlands Cadastre and Land Registry Agency*. Paper presented at the Strategies for Renewal of Information Systems and

Information Technology for Land Registry and Cadastre: Proceedings of a Symposium Held by FIG Commission 7 and 8, ITC, Enchede, The Netherlands, May, 9, 2003.
Ding, W. & Lin, X. (2010). *Information Architecture*: Morgan and Claypool Publishers.
EC. (2007). *Breaking Barriers to e-Government: A Legal and Institutional Analysis of Barriers to e-Government* European Commission.
EC. (2010a). *The European e-Government Action Plan 2011-2015*: European Commission.
EC. (2010b). *INSPIRE Data Specification on Cadastral Parcels –Guidelines*: INSPIRE Thematic Working Group Cadastral Parcels, European Commission.
Ellenkamp, Y. & Maessen, B. (2009). *Napoleon's Registration Principles in Present Times : The Dutch System of Key Registers*. Paper presented at the 11th International Conference for Spatial Data Infrastructure. Netherlands, June 15-19, 2009.
Eriksson, H. E. & Penker, M. (2000). *Business Modeling with UML: Business Patterns at Work*: John Wiley and Sons, Inc.
EU. (2010). *Europe's Digital Competitiveness Report*. Last visited http://ec.europa.eu/information_society/digital-agenda/documents/edcr.pdf on 5th January, 2012.
FAO. (2011a). *FAO FLOOS SOLA Software Architecture Document - SOLA Development Snapshot*. In M. Andrew (Eds.) Last visited http://flossola.org/sites/default/files/sola_software_architecture_document_v1.1_0.pdf on 9th February, 2011
FAO. (2011b). *Statement of Requirements - Initial "Solution for Open Land Administration" (SOLA) Software for the FAO Open Cadastre and Registration Project*. In P. Neil (Eds.) Last visited http://flossola.org/sites/default/files/statementofrequirementsinitialsolasoftwarev1.1_0.pdf on 9th February, 2011
Fountain, J. E. (2001). *Building the Virtual State : Information Technology and Institutional Change*. Washington, D.C.: Brookings Institution Press.
Fountain, J. E. (2004). *Prospects of Virtual State*. Last visited http://www.j.u-tokyo.ac.jp/coeps/pdf/040710.pdf on 20th August, 2011.
Godse, V. & Garg, A. (2007). *From e-Government to e-Governance*. Last visited http://www.csi-sigegov.org/1/2_313.pdf on 25th April, 2011.
Goldfinch, S., Gauld, R. & Baldwin, N. (2011). Information and Communications Technology Use, e-Government, Pain and Stress Amongst Public Servants. *New Technology Work and Employment, 26*(1), 39-53.
GoN. (2008). *Electronic Transaction Act*.Government of Nepal.
Haki, M. K. & Forte, M. W. (2010). Inter-Organizational Information System Architecture: A Service-Oriented Approach. In L. M. Camarinha, X. Boucher & H. Afsarmanesh (Eds.), *Collaborative Networks for a Sustainable World*, (Vol. 336), 642-652: Springer Berlin Heidelberg.
Heeks, R. (2003). *Most e-Government for Development Projects Fail: How Can Risks be Reduced?* Last visited http://www.sed.manchester.ac.uk/ on 6th December 2011.
Heeks, R. (2008). *Success and Failure in e-Government Projects*. Last visited http://www.egov4dev.org/success/ on 6th December 2011.
Hein, V. D. & Vries, M. d. (2003). *Upstream! Chronicle of the Streamlining Key Data Program*.
HLCIT. (2006). *e-Government Master Plan Consulting Report*. Government of Nepal.
HLCIT. (2011a). *Nepal e-Government Interoperability Framework-Main Report*. Government of Nepal.
HLCIT. (2011b). *Nepal GEA Infrastructure Architecture*. Government of Nepal.
Hobson, S., Anand, R., Yang, J. & Lee, J. (2011). Towards Interoperability in Municipal Government: A Study of Information Sharing Practices. In P. Campos, N. Graham, J. Jorge, N. Nunes, P. Palanque & M. Winckler (Eds.), *Human-Computer Interaction – INTERACT 2011*, (Vol. 6946), 233-247: Springer Berlin / Heidelberg.
Hof, S. v. d. (2007). The Status of e-Government in the Netherlands. *Electronic Journal of Comparative Law, 11*(1), 1-18.
Hoffmann, W. (2003). *Going Digital to Fulfil Customer Needs BEVs Efforts Streamlining the Supply Chain with Information Technology*. Paper presented at the Strategies for Renewal of Information Systems and Information Technology for Land Registry and Cadastre : Proceedings of a Symposium Held by FIG Commission 7 and 8, ITC, Enschede, The Netherlands, May 9, 2003.
Hossan, C. G., Habib, M. W. & Kushchu, I. (2006). *Success and Failure Factors of e-Government Projects Implementation in Developing Countries: A Study on the Perception of Government Officials of Bangladesh*. Last visited http://www.mgovernment.org/resurces/9_Chowdhurykushchu.pdf on 20th June, 2011.

Imran, A. & Gregor, S. (2010). Uncovering the Hidden Issues in e-Government Adoption in a Least Developed Country: The Case of Bangladesh. *Journal of Global Information Management, 18*(2), 30-56.

IRMT. (2007). *India, Karnatak State Case Study: Fostering Trust and Transparancy in Governance*. International Records Management Trust.

ISO/IEC 42010. (2007). *Recommended Practice for Architectural Description of Software-Intensive Systems*. ISO, Geneva.

Ivan, G., Szabo, G., Weninger, Z. & Zalaba, P. (2010). *DATR - Towards e-Land Administration in Hungary*. Paper presented at the Facing the Challanges - Building the Capacity, FIG Congress, 2010. Sydney, Australia, 11-16 April, 2010.

Junseok, H. & Syamsuddin, I. (2008). *Failure of e-Government Implementation: A Case Study of South Sulawesi*. Paper presented at the Third International Conference on Convergence and Hybrid Information Technology, 2008.

Kalantari, M., Rajabifard, A., Wallace, J. & Williamson, I. (2005). *Towards e-Land Administration:Australian Online Land Information Services*. Paper presented at the SSC 2005 Spatial Intelligence, Innovation and Praxis: The National Biennial Conference of the Spatial Science Institute, Melbourne, Australia, September, 2005.

Karim, N. S. A., Nordin, Z. A., Maidin, A. J. & Ismail, M. S. (2010). *Electronic Land Administration System in Malaysia: A Proposed Review from ICT and Legal Perspectives*. Paper presented at the International Symposium in Information Technology (ITSim), 2010 Kuala Lumpur.

Ke, W. L. & Wei, K. K. (2004). Successful e-Government in Singapore - How did Singapore Manage to Get Most of its Public Services Deliverable Online? *Communications of the Acm, 47*(6), 95-99.

Kharel, P. & Shakya, S. (2011). Failure Factors of e-Government Implementation in Nepal. *International Journal of Applied Engineering Research, 6*(18), 2118-2122.

Kim, H. B., Kim, H. T. & Ha, D. S. (2008). *The Current Status and Development Direction of Korea Land Information System (KLIS)*. Paper presented at the Tenth International Conference for Spatial Data Infrastructure, St. Augustine, Trinidad, 25-29 February, 2008.

Klischewski, R. (2011). Architectures for Tinkering? Contextual Strategies Towards Interoperability in e-Government. *Journal of Theoretical and Applied Electronic Commerce Research, 6*(1), 26-42.

Kumar, R. (2005). *Research Methodology : A Step - by - step Guide for Beginners* (Second edition ed.). London etc.: Sage.

Lambrinoudakis, C., Gritzalis, S., Dridi, F. & Pernul, G. (2003). Security Requirements for e-Government Services: A Methodological Approach for Developing a Common PKI-based Security Policy. *Computer Communications, 26*(16), 1873-1883.

Layne, K. & Lee, J. W. (2001). Developing Fully Functional e-Government: A Four Stage Model. *Government Information Quarterly, 18*(2), 122-136.

Lin, F., Fofanah, S. S. & Liang, D. (2011). Assessing Citizen Adoption of e-Government Initiatives in Gambia: A Validation of the Technology Acceptance Model in Information Systems Success. *Government Information Quarterly, 28*(2), 271-279.

Meijer, A., Boersma, K. & Wagenaar, P. (2009). Hypes:Love Them or Hate Them. In A. Meijer, K. Boersma & P. Wagenaar (Eds.), *ICTs, Citizens and Governance: After the Hype!*, (Vol. 14), 3-9: IOS Press.

Meneklis, V. & Douligeris, C. (2010). Bridging Theory and Practice in e-Government: A Set of Guidelines for Architectural Design. *Government Information Quarterly, 27*(1), 70-81.

Minli, J., Decai, K. & Wuliang, P. (2010). *Research of Information System Technology Architecture*. Paper presented at the 2nd International Conference on Industrial and Information Systems (IIS).

Molen, P. v. d. (2005). *Authentic Registers and Good Governance*. Paper presented at the Pharaohs to Geoinformatics, FIG working Week 2005 and GSDI-8, Egypt, Cairo, 16-21 April, 2005

Molen, P. v. d. (2010). *Country Report, 2010*. Kadaster International.

Molen, P. v. d., Groothedde, A., Lemmen, C. & Oosterom, P. v. (2008). A Standardized Land Administration Domain Model As Part Of The (spatial) Information Infrastructure. *Creating Spatial Information Infrastructures*, 129-150: CRC Press.

Molen, P. v. d. & Lemmen, C. H. J. (2003). *Strategies for Renewal of Information Systems and Information Technology for Land Registry and Cadastre : Editorial*. Paper presented at the Strategies for Renewal of Information Systems and Information Technology for Land Registry and Cadastre : Proceedings of a Symposium Held by FIG Commission 7 and 8, ITC, Enschede, The Netherlands, May 9, 2003.

Molen, P. v. d. & Wubbe, M. (2007). *e-Government and e-Land Administration as an Example: The Netherlands*. Paper presented at the 6th FIG Regional Conference, San Jose, Costa Rica. 12-15 November, 2007

Morales, J. M. & Vissers, C. A. (2004). *Model - driven design of geo - information services*. ITC, Enschede.
MPAS & NIA. (2011). *e-Government of Korea: Best Practices*. Last visited http://www.korea.go.kr/new_eng/service on 6th December, 2011.
Navarra, D. D. (2010). *Architecture of Global Governance : A Case Study of e-Government in Jordan*: Lambert Academic Publishing AG & Co KG.
OECD. (2003). *The e-Government Imperative: Main Findings*: Organization for Economic Co-operation and Development.
Ogilvie, M. & Mulhollnad, G. (2004). *Land Information-Catalyst for Integrated e-Government*. Paper presented at the e-Land Administraion, A seminar held by FIG commission 7 at Innsbruck, Austria, 2-4 June, 2004
Oliver, K. T. (2002). *Problems in Computerizing the Ministry of Foreign Affairs*. Last visited http://www.egov4dev.org/success/case on 7th December, 2011.
Ossko, A. (2007). *Cadastre, Land Administration Systems and e-Government*. Paper presented at the Strategic Integration of Surveying Services, FIG Working Week 2007. Hong Kong, May 13-17.
Papadomichelaki, X., Magoutas, B., Halaris, C., Apostolou, D. & Mentzas, G. (2006). A Review of Quality Dimensions in e-Government Services. In M. Wimmer, H. Scholl, Å. Grönlund & K. Andersen (Eds.), *Electronic Government*, (Vol. 4084), 128-138: Springer Berlin / Heidelberg.
Papadomichelaki, X. & Mentzas, G. (2012). e-GovQual: A Multiple-item Scale for Assessing e-Government Service Quality. *Government Information Quarterly, 29*(1), 98-109.
Pariyar, M. P. (2007). *e-Government Initiatives in Nepal: Challenges and Opportunities*. Paper presented at the 1st international conference on Theory and practice of electronic governance, Macao, China., Macao, China, 10-13 December, 2007
Paul, T. J. (2004). Beyond Section 508: The Spectrum of Legal Requirements for Accessible e-Government Web Sites in the United States. *Journal of Government Information, 30*(4), 518-533.
Quirchmayr, G., Funilkul, S. & Chutimaskul, W. (2007). *A Quality Model of e-Government Services Based on the ISO/IEC 9126 Standard*. Paper presented at the Integrated Risk Information System (IRIS), 2007.
Ratnayake, R. M. S. B. (2010). *Internal Requirements for E-land Administration in Nepal*. ITC/University of Twente, Enschede.
Reddick, C. G. & Turner, M. (2012). Channel Choice and Public Service Delivery in Canada: Comparing e-Government to Traditional Service Delivery. *Government Information Quarterly, 29*(1), 1-11.
Rombach, D. & Steffens, P. (2009). *e-Government: Springer Handbook of Automation*: Springer Berlin Heidelberg.
Royce, W. W. (1987). *Managing the Development of Large Software Systems: Concepts and Techniques*. Paper presented at the Proceedings of the 9th International Conference on Software Engineering, IEEE Computer Society Press, Monterey, California, United States, pg 328-338, 2 April, 1987
Sandoval-Almazan, R. & Gil-Garcia, J. R. (2012). Are Government Internet Portals Evolving Towards More Interaction, Participation, and Collaboration? Revisiting the Rhetoric of e-Government Among Municipalities. *Government Information Quarterly, 29, Supplement 1*(0), S72-S81.
Schellong, A. (2007). *Extending the Technology Enactment Framewrok*. Last visited http://www.hks.harvard.edu/netgov/files/png_workingpaper_series/PNG07-003_WorkingPaper_extending_technology_enactment_framework_schellong.pdf on 17th August, 2011.
Selleri, M. & Fabrizi, C. (2003). *The Role of ICT in the Devolution of Cadastral Services*. Paper presented at the Strategies for Renewal of Information Systems and Information Technology for Land Registry and Cadastre : Proceedings of a Symposium Held by FIG commission 7 and 8, ITC, Enschede, The Netherlands, May 9, 2003.
Shareef, M. A., Kumar, V., Kumar, U. & Dwivedi, Y. K. (2011). e-Government Adoption Model (GAM): Differing Service Maturity Levels. *Government Information Quarterly, 28*(1), 17-35.
Silva, M. A. & Stubkjær, E. (2002). A Review of Methodologies Used in Research on Cadastral Development. *Computers, Environment and Urban Systems, 26*(5), 403-423.
Subedi, G. P. (2009). *Designing a User Oriented Business Process for Land Registration : A Case Study of Nepal*. ITC, Enschede.
Suchanek, V. & Jirman, J. (2003). *Information System of the Cadastre of Real Estates of the Czech Republic*. Paper presented at the Strategies for Renewal of Information Systems and Information Technology for Land Registry and Cadastre : Proceedings of a Symposium Held by FIG commission 7 and 8, ITC, Enschede, The Netherlands, May 9, 2003.

Tam, D. T. M. (2010). *Designing e-Government Based Land Administration System (e-LAS) for Improving Delivery of Land Administration Services*. University of Twente, Enschede.

Thapa, D. (2011). The Role of ICT Actors and Networks in Development: The Case Study of a Wireless Project in Nepal. *Electronic Journal on Information Systems in Developing Countries, 49*(1), 1-16.

The Open Group. (2007). *Service Oriented Architecture*. Last visited www.togaf.com on 5th August, 2011.

The Open Group. (2009). *The Open Group Architecture Framework (TOGAF)*. Last visited http://www.opengroup.org/togaf/ on 25th October, 2011

The World Bank. (2011). *Definition of e-Government*. Last visited http://go.worldbank.org/M1JHE0Z280 on 22nd November, 2011.

Thomas, P. (2009). Bhoomi, Gyan Ganga, e-Governance and the Right to Information: ICTs and Development in India. *Telematics and Informatics, 26*(1), 20-31.

Trauth, E. M. (2001). *Qualitative research in IS : Issues and Trends*. Hershey: Idea Group.

Tuladhar, A. M. (2003). *Reengineering Cadastre and Land Registration Systems and Business Opportunities*. Paper presented at the FIG working week and 125th anniversary : Still on the Frontline, Paris, 13-17 April, 2007

Tuladhar, A. M. (2004). *Parcel-based Geo-information System: Concepts and Guidelines*. ITC, Enschede.

Tuladhar, A. M., BC, K. R. & Budhathoki, N. R. (2002). *Towards Strategic Planning for Building Land Information System LIS in Nepal*. Paper presented at the 23th Asian conference on Remote Sensing, ACRS 2002, Kathmandu, Nepal 25-29 November.

UN. (2005). *Land Administration in the UNECE Region*. Geneva. United Nations.

UN. (2010). *e-Government Survey 2010, Leveraging e-Government at a Time of Financial and Economic Crisis*. New York. United Nations.

UNPAN. (2009). *Compendium of Innovative e-Government Practice* (Vol. III): United Nations Organizations.

Versteeg, G. & Bouwman, H. (2006). Business Architecture: A New Paradigm to Relate Business Strategy to ICT. *Information Systems Frontiers, 8*(2), 91-102.

Wang, J. F. (2009). *e-Government Security Management: Key Factors and Countermeasure*. Paper presented at the Fifth International Conference on Information Assurance and Security, 2009. IAS '09, 18-20 August, 2009

Weerakkody, V., El-Haddadeh, R., Sabol, T., Ghoneim, A. & Dzupka, P. (2012). e-Government Implementation Strategies in Developed and Transition Economies: A Comparative Study. *International Journal of Information Management, 32*(1), 66-74.

West, D. M. (2004). e-Government and the Transformation of Service Delivery and Citizen Attitudes. *Public Administration Review, 64*(1), 15-27.

Williamson, I. & Fourie, C. (1998). Using the Case Study Methodology for Cadastral Reform. *Geometica, 52*(3).

Yang, T.-M., Zheng, L. & Pardo, T. (2012). The Boundaries of Information Sharing and Integration: A Case Study of Taiwan e-Government. *Government Information Quarterly, 29, Supplement 1*(0), S51-S60.

Yildiz, M. (2007). e-Government Research: Reviewing the Literature, Limitations, and Ways Forward. *Government Information Quarterly, 24*(3), 646-665.

Yin, R. K. (2003). *Case Study Research : Design and Methods* (Third edition ed. Vol. 5). Newbury Park etc.: Sage.

Yoon, J. & Chae, M. (2009). Varying Criticality of Key Success Factors of National e-Strategy Along the Status of Economic Development of Nations. *Government Information Quarterly, 26*(1), 25-34.

Zakareya, E. & zahir, I. (2005). e-Government Adoption: Architecture and Barriers. *Business Process Management Journal, 11*(5), 589-611.

Zarei, B. & Ghapanchi, A. (2008). Guidelines for Government-to-government Initiative Architecture in Developing Countries. *International Journal of Information Management, 28*(4), 277-284.

Zevenbergen, J. A., Uitermark, H. T. & Lemmen, C. H. J. (2009). *Cadastral Information : More than Base Data*. Paper presented at the Core spatial data : NCG seminar on the occasion of the 25th year jubilee of Mathias J.P.M. Lemmens TU Delft.

Zhao, J. J. & Zhao, S. Y. (2010). Opportunities and Threats: A Security Assessment of State e-Government Websites. *Government Information Quarterly, 27*(1), 49-56.

Zhao, Y. (2010). *One Map Based Land Information System*. Paper presented at the International Conference on e-Business and e-Government, China, 7-9 May, 2010.

ANNEXES

Annex A: List of respondents

SN	Name	Designation	Organization
1.	Lalmani Joshi	Secretary	Ministry of Land Reform and Management
2.	Juddha Bahadur Gurung	Member Secretary	High Level Commission for Information Technology
3.	Krishna Raj BC	Director General	Survey Department
4.	Jeet Bahadur Thapa	Director General	Department of Land Reform and Management
5.	Drona Pokharel	Director	Department of Land Information and Archives
6.	Diwakar Luitel	Administrative Officer	National Information Technology Center (NITC/GIDC)
7.	Sudeep Dangi	Assistant Director	National Information Technology Center (NITC/GIDC)
8.	Narayan Raj Timilsina	Under Secretary	Office of Prime Minister and Council of Ministers
9.	Indira Dahal	Under Secretary	Ministry of Law and Justice
10.	Ram Krishna Uprety	Executive Officer	Madhyapur Thimi Municipaltiy
11.	Gopal Prasad Regmi	Executive Officer	Bhaktapur Municipality
12.	Narayan Prasad Gyanwali	Executive Officer	Lekhnath Municipalty
13.	Meghnath Kaphle	Executive Officer	Pokhara Sub-Metropolitan City
14.	Heera Shakya	Deputy Manager	Everest Bank
15.	Dhananjaya Sharma	Deputy Manager	National Bank of Nepal, Kaski Branch
16.	Rohit Bhattarai	Chief Revenue Officer	District Land Revenue Office, Bhaktapur
17.	Umesh Joshi	Chief Survey Officer	District Survey Office, Kaski
18.	Mukunda Prasad Dhakal	Chief Revenue Officer	Distrct Land Revenue Office, Kaski
19.	Balbhadra Jha	Survey Officer	District Survey Office, Bhaktapur
20.	Purushottam Kharel	PhD Researcher	Kathmandu University
21.	Hira Gopal Maharjan	Computer Engineer	Department of Land Reform and Management
22.	Nar Bahadur Chand	Senior Surveyor	District Survey Office, Kaski
23.	Ram Datta Bhatta	Computer Engineer	Department of Land Information and Archives
24.	Surav Amatya	ADB Consultant	ICT Development Project
25.	Peter Oukes	System Architect	Cadastre, Land Registry and Mapping Agency, Netherlands
26.	Anish Joshi	Private Consultant/ General Secretary	NRSPS
27.	Rajendra Basnet	Chairman	Nepal Legal Writer's Association
28.	Dhana Bahadur Thapa	Deed Writer	Kaski District
29.	Shreedhar Shrestha	Deed Writer	Valley Legal Service Center
30.	Sanjeet Pradhan	Junior Engineer	Pokhara Sub-Metropolitan City

Annex B: Photographs of field work

Secretary, Ministry of Land Reform and Management

Member Secretary, High Level Commission for Information Technology

Director General, Department of Land Reform and Management

Director, Department of Land Information and Archives

Deputy Manager, Everest Bank

Deputy Manager, National Bank of Nepal, Kaski branch

Chief Revenue Officer, Land Revenue Office, Kaski

Chief Survey Officer, Survey Office, Kaski

Executive Officer, Pokhara Municipality

Executive Officer, Lekhnath Municipality

Chairman, Nepal Deed Writer Association, Bhaktapur

Junior Engineer, Pokhara Municipality

Annex C: Interview questions

A: Interview questions for OPMCM/HLCIT/GIDC

1. Organization and respondent information

1.1 Organization's name:……..
Date:……
1.2 Respondent's name: ……
Position: .....
1.3 How long you have been working in this organization in this position? .....

2. Organization's responsibility in e-government

2.1 What is the main responsibility of your organization in establishing e-government?
2.2 Do you have separate section for supporting e-government?
2.3 Do you have specific policy supporting e-government?
2.4 Is there any program running for supporting e-government?
2.5 Is there any land related programs under execution?
2.6 Is there any laws about data bank/storing data/integrated data center?
2.7 What is your opinion about authentic register? Can land register be taken as authentic register?
2.8 Is there legal provision of electronic signature? What about biometric data like finger print?
2.9 What is your opinion about the submission of electronic application? Do we have supporting laws for this?
2.10 Will it be beneficial if electronic payment system (e-sewa) can be implemented for government services?
2.11 Does the law supports for copyright or reuse of the data? Does it imply to land data as well?
2.12 Is there law/act about security of data?
2.13 Who should be liable for the data produced?

3. Organization's opinion on access to information

3.1 What do you say about providing information to the citizens online?
3.2 Is there any policy which says about providing easy access to information to citizen?
3.3 Is there any difficulty in linking and sharing data among government organizations? What about the policy?
3.4 What will be the benefit if database of government organizations are linked and shared with each other?
3.5 Should there be any restriction in access to some of the information? It means privacy of the data.
3.6 Anything else you want to add please?

B: Interview questions for secretary of MoLRM

1. Organization and respondent information

1.1 Organization's name:……
Date: ……
1.2 Respondent's name: ……
Position: .....
1.3 How long you have been working in this organization in this position?.....

2. Organization's responsibility in LIS

2.1 What is the main responsibility of your organization in establishing e-government?
2.2 Do you have separate section for supporting land information system?
2.3 What do you say about the policy supporting LIS? Is there sufficient policy?
2.4 Can you tell me about the computer experts available in your organization?
2.5 Is there any laws about data bank/storing data/integrated data center?
2.6 What is your opinion about authentic register? Can land register be taken as authentic register?
2.7 Is there legal provision of electronic signature? What about biometric data like finger print?

2.8 What is your opinion about the submission of electronic application? Do we have supporting laws for this?
2.9 Will it be beneficial if electronic payment system (e-sewa) can be implemented for government services?
2.10 Does the law supports for copyright or reuse of the data? Does it imply to land data as well?
2.11 Is there law/act about security of data?
2.12 Who should be liable for the data produced?
2.13 What do you say about integration of land administration office at district? Will it bring the improvements or fulfill the user's requirement in land administration services?
2.14 What is your opinion about forming council of representatives from you and cooperate for implementation of e-government?
2.15 Will it support in successful implementation of e-government (e-land administration)?

3. Organization's opinion on access to information

3.1 What is the situation of providing information to the citizens? Easy or difficult?
3.2 What do you say about providing information to the citizens online?
3.3 Is there any policy which says about providing easy access to information to citizen?
3.4 Do you think that stating provision of providing information in policy helps in increasing access to information?
3.5 Is there any difficulty in linking and sharing data among government organizations?
3.6 What will be the benefit if database of government organizations are linked and shared with each other?
3.7 Should there be any restriction in access to some of the information?
3.8 Anything else you want to add please?

C: Interview questions for director general of DOS/DOLRM/DOLIA

1. Organization and respondent information

1.1 Organization's name: ……
Date: ……
1.2 Respondent's name: ……
Position: .....
1.3 1.3How long you have been working in this organization in this position?.....

2. Organization's responsibility in LIS

2.1 What is the main responsibility of your organization in establishing e-government?
2.2 Do you have separate section for supporting land information system?
2.3 Can you tell me about the computer experts available in your organization?
2.4 How many organizations are relating to land besides land administration offices? Can you list the organizations that needs land information in their business?
2.5 Of how many district offices, digital database has been established?
2.6 Has the district offices with digital database has gone for transactions?
2.7 Are the human resources working in district office are enough or not?
2.8 Are the human resources are IT literate and capable of doing digital transactions? Do you have any plan to improve the capacity of the human resources?
2.9 What do you say about the policy supporting LIS? Is the existing policy sufficient?
2.10 What are the problems if there is lack of policy?
2.11 Is the present architecture of land information is complete for supporting e-government (e-land administration)?
2.12 If not what should be done further to develop more perfect architecture?
2.13 Is there any laws about data bank/storing data/integrated data center?
2.14 What is your opinion about authentic register? Can land register be taken as authentic register?
2.15 Is there legal provision of electronic signature? What about biometric data like finger print?
2.16 What is your opinion about the submission of electronic application? Do we have supporting laws for this?
2.17 Will it be beneficial if electronic payment system (e-sewa) can be implemented for government services?

2.18 Does the law supports for copyright or reuse of the data? Does it imply to land data as well?
2.19 Is there law/act about security of data?
2.20 Who should be liable for the data produced?
2.21 What do you say about integration of land administration office at district? Will it bring the improvements or fulfill the user's requirement in land administration services?
2.22 What is your opinion about forming council of representatives from you and cooperate for implementation of e-government?
2.23 Will it support in successful implementation of e-government (e-land administration)?

3. Organization's opinion on access to information

3.1 What is the situation of providing information to the citizens? Easy or difficult?
3.2 Does current business process support in providing information?
3.3 What do you say about providing information to the citizens online?
3.4 Is there any policy which says about providing easy access to information to citizen?
3.5 Do you think that stating provision of providing information in policy helps in increasing access to information?
3.6 How many different organization's data you may need during your business?
3.7 Is there any difficulty in linking and sharing data among government organizations?
3.8 What will be the benefit if database of government organizations are linked and shared with each other?
3.9 Should there be any restriction in access to some of the information?

Anything else you want to add please?

D: Interview questions for municipality

1. Organization and respondent information

1.1 Organization's name:…….
Date: ……..
1.2 Respondent's name: ……
Position: .....
1.3 How long you have been working in this organization in this position?.....

2. Organization's responsibility in service delivery

2.1 What kind of information about the citizens do you have?
2.2 Is the information stored digital or in paper?
2.3 Do you have any role in land registration?
2.4 What kind of service do you provide related to land?
2.5 What is the information you require to provide those services?
2.6 Do you have your own database of that information? [IF Yes go to 2.7ELSEGO TO 2.10]
2.7 What kind of database do you have?
2.8 If digital is that online system? How do you manage the system?
2.9 If paper, how do you update and manage?
2.10 How do you provide that information to customer?
2.11 What kind of information you need from land administration offices?
2.12 How do you get that information?
2.13 Any difficulties in getting information?
2.14 How to minimize those difficulties?
2.15 Does land administration office ask for any kind of information?
2.16 How do you provide that information?
2.17 Is there any laws about data bank/storing data/integrated data center?
2.18 What is your opinion about authentic register? Which data can be authentic register?
2.19 Is there legal provision of electronic signature? What about biometric data like finger print?
2.20 What is your opinion about the submission of electronic application? Do we have supporting laws for this?
2.21 Will it be beneficial if electronic payment system (e-sewa) can be implemented for government services?
2.22 Does the law supports for copyright or reuse of the data? Does it imply to land data as well?

2.23 Is there law/act about security of data?
2.24 Who should be liable for the data produced?

3. Organization's opinion on access to information

3.1 Can you list the government organizations that expect information from you?
3.2 Which organization's data do you need for your daily business?
3.3 What do you say about providing information to the customers online?
3.4 What do you say if land administration office provides information online to you?
3.5 Is there any difficulty in sharing your data with other government organizations?
3.6 What will be the benefit if database of municipality and other government organizations are linked and shared with each other?
3.7 Should there be any restriction in access to some of the information? What are they?
3.8 Anything else you want to add please?

E: Interview questions for district survey and revenue offices

1. Organization information

1.1 Organization's name: ……
Date: …….
1.2 District: ……
1.3 1.3Respondent's Name: ……
Position: …….....
1.4 1.4How long you have been working for in this office and in this same position? ……

2. Respondent opinion about service delivery

2.1 Who are the users of the land administration services?
2.2 What are the different organizations that you need information from?
2.3 Can you list the organizations that ask for information from your organization?
2.4 What is the status of establishing digital database?
2.5 Can you tell me about the computer experts available in your organization?
2.6 Are the human resources enough or not?
2.7 Are the human resources IT literate and capable of doing digital transactions?
2.8 What is the basic legal document that you follow in your business?
2.9 Is there enough policy to support computer based land administration service?
2.10 Is the present architecture of land information is complete for supporting e-government (e-land administration)?
2.11 What are the problems in this system?
2.12 What should be done further to develop more perfect architecture?
2.13 What is your opinion about authentic register? Can land register be taken as authentic register?
2.14 Is there legal provision of electronic signature? What about biometric data like finger print?
2.15 What is your opinion about the submission of electronic application? Do we have supporting laws for this?
2.16 Will it be beneficial if electronic payment system (e-sewa) can be implemented for government services?
2.17 Does the law supports for copyright or reuse of the data? Does it imply to land data as well?
2.18 Is there law/act about security of data?
2.19 Who should be liable for the data produced?
2.20 What do you say about integration of land administration office at district? Will it bring the improvements or fulfill the user's requirement in land administration services?

3. Respondent's opinion on access to information

3.1 How many hours do you need to search for required information from archives?
3.2 Is the information easily accessible?
3.3 Is the information about process/cost easily accessible?
3.4 What do you say about providing information online to customer?
3.5 Is there any policy supporting easy access to customer via different means?

3.6 Is there any difficulty in linking and sharing data among government organizations (like municipality) ?
3.7 What will be the benefit if database of government organizations are linked and shared with each other?
3.8 Should there be any restriction in access to some of the information?
3.9 Anything else you want to add please?

F: Interview questions for computer expert at GIDC/HLCIT

1. Organization and respondent information
1.1 Organization's name: ……
Date: ……
1.2 Respondent's name: ……
Position: .....
1.3 How long you have been working in this organization in this position? .....

2. Organization's responsibility in e-government
2.1 What do you say about the responsibility of your organization in establishing e-government?
2.2 What is the main objective of your organization?
2.3 Can you explain about the security system in your organization?
2.4 Can you explain about the objective of your organization in architectural concept?
2.5 Is there any specification of the hardware and software to be used for your objectives? Is this policy bound?
2.6 Is there any laws about data bank/storing data/integrated data center?
2.7 Is there legal provision of electronic signature? What about biometric data like finger print?
2.8 What is your opinion about the submission of electronic application? Do we have supporting laws for this?
2.9 Will it be beneficial if electronic payment system (e-sewa) can be implemented for government services?
2.10 Does the law supports for copyright or reuse of the data? Does it imply to land data as well?
2.11 Is there law/act about security of data?
2.12 Who should be liable for the data produced?

3. Organization's opinion on access to information
3.1 What do you say about providing information to the citizens online?
3.2 Is there any policy which says about providing easy access to information to citizen?
3.3 Is there any difficulty in linking and sharing data among government organizations? What about the policy?
3.4 What will be the benefit if database of government organizations are linked and shared with each other?
3.5 Should there be any restriction in access to some of the information? It means privacy of the data.
3.6 Anything else you want to add please?

G: Interview questions for computer expert at departments

1. Organization and respondent information
1.1 Organization's name: ……
Date: ……
1.2 Respondent's name: ……
Position: .....
1.3 How long you have been working in this organization in this position? .....

2. Organization's responsibility in e-government
2.1 What do you say about the responsibility of your organization in establishing e-government?
2.2 What is the main objective of your organization?
2.3 Can you explain about the security system in existing LIS?
2.4 Can you explain about the architectural concept of LIS?

2.5 Is the existing system architecture of LIS is enough to support e-government?
2.6 What are the problems in this system?
2.7 What should be done to come over the problems? Is there any future plan in this sector?
2.8 Is there any specification of the hardware and software to be used for your system? Is this policy bound?
2.9 Is there any laws about data bank/storing data/integrated data center?
2.10 Is there legal provision of electronic signature? What about biometric data like finger print?
2.11 What is your opinion about the submission of electronic application? Do we have supporting laws for this?
2.12 Will it be beneficial if electronic payment system (e-sewa) can be implemented for government services?
2.13 Does the law supports for copyright or reuse of the data? Does it imply to land data as well?
2.14 Is there law/act about security of data?
2.15 Who should be liable for the data produced?

3. Organization's opinion on access to information

3.1 What do you say about providing information to the citizens online?
3.2 Is there any policy which says about providing easy access to information to citizen?
3.3 Is there any difficulty in linking and sharing data among government organizations? What about the policy?
3.4 What will be the benefit if database of government organizations are linked and shared with each other?
3.5 Should there be any restriction in access to some of the information? It means privacy of the data.
3.6 Anything else you want to add please?

H: Interview questions for academician

1. Organization and respondent information

1.1 Organization's name:……..
Date:……
1.2 Respondent's name: ……
Position: .....
1.3 How long you have been working in this organization in this position?.....

2. Organization's opinion in e-government

2.1 What is the present status of e-government initiative?
2.2 What do you say about legal provision for implementation of e-government?
2.3 Do you agree on creating one integrated data center? Will law support for this purpose?
2.4 What is your opinion on assigning some government data as authentic register?
2.5 Is there legal provision of electronic signature? What about biometric data like finger print?
2.6 What will you say about feasibility of electronic conveyancing?
2.7 Will it be beneficial if electronic payment system (e-sewa) can be implemented for government services?
2.8 Is there law/act about security of data?
2.9 Who should be liable for the data produced?

3. Organization's opinion on access to information

3.1 What do you say about providing information to the citizens online?
3.2 Is there any policy which says about providing easy access to information to citizen?
3.3 Is there any difficulty in linking and sharing data among government organizations? What about the policy?
3.4 What will be the benefit if database of government organizations are linked and shared with each other?
3.5 Should there be any restriction in access to some of the information? It means privacy of the data.
3.6 Anything else you want to add please?

I: Interview questions for bank

1. Organization and respondent information

1.1 Organization's name: …….
Date: ……..
1.2 Respondent's name: ……
Position: .....
1.3 1.3How long you have been working in this organization in this position?.....

2. Organization's responsibility in service delivery

2.1 Do you have digital or paper based database system?
2.2 Do you have e-banking system? If yes what service do you provide?
2.3 What kind of service do you provide related to land?
2.4 What is the information you require to provide those services?
2.5 What kind of information you need from land administration offices?
2.6 How do you get that information?
2.7 Does land administration office ask for any kind of information?
2.8 How do you provide that information?
2.9 Can you tell me about your human resources in the field of computer technology?
2.10 Will it be benefits if electronic payment system (e-sewa) can be implemented for government services?
2.11 What is your opinion on e-payment service in land administration sector? Is your bank capable and ready to provide this service?
2.12 Do you need separate law/policy for providing that service?
2.13 Is there law/act about security of data?

3. Organization's opinion on access to information

3.1 What do you say about providing information to the customers online?
3.2 What do you say if land administration office provides information online to you?
3.3 Is there any legal bound that the government should have access to the bank data?
3.4 Do you think that government should not have viewing access to the bank database?
3.5 Should there be any restriction in access to some of the database? What are they?
3.6 Anything else you want to add please?

J: Interview questions for real estate agents/Writers/Notaries

1. Organization and/or respondent information

1.1 Organization's name: ……
Date: ……..
1.2 Respondent's name: ……
Position: .....
1.3 How long you have been working in this organization in this position?.....

2. Organization's opinion about service delivery

2.1 How do you get the required information from the land administration office?
2.2 How many offices do you need to visit for the information?
2.3 What is the present condition of the data and information in those organizations?
2.4 Do you also need to visit other organizations except land administration offices?
2.5 What do you think about the link between the information among the organizations? Is there any overlap?
2.6 Is there any specific law for your business?
2.7 Is existing land laws sufficient for your purpose? What are the gaps that you feel?
2.8 What do you think about electronic submission of deeds? Do you need separate law for this provision?
2.9 Is the policy supportive to use biometric data like digital finger print?

2.10 What is your opinion about using banks for electronic payment of the service? Is the existing law enough or you need separate law for this?
2.11 Do you have any comments about the present organization structure of land administration offices?
2.12 What is your opinion about forming council of representatives from you and cooperate for implementation of e-government?
2.13 Will it support in successful implementation of e-government (e-land administration)?

3. Organization's opinion on access to information

3.1 What do you say if land administration office provides information online to you?
3.2 What will be the benefit if database of government organizations are linked and shared with each other?
3.3 Will that provide easy access to the information for the customers?
3.4 Should there be any restriction in access to some of the information? What are they?
3.5 Anything else you want to add please?

Annex D: Information Technology Infrastructure Library

- **Service Delivery**.
  - *Financial Management for IT Services (FMITS)*
  - *Capacity Management*
  - *Availability Management*
  - *IT Service Continuity Management (ITSCM)*
  - *Service Level Management*
  - *Security Management*
- **Service Support**.
  - *Change Management*
  - *Release Management*
  - *Problem Management*
  - *Incident Management*
  - *Configuration Management*
  - *Service Desk*
- **ICT Infrastructure Management**.
  - *Network service Management*
  - *Operations Management*
  - *Management of local processors*
  - *Computer installation and acceptance*
  - *Systems Management*
- **The Business Perspective**.
- **Application Management**
- **Software Asset Managemet**