

Addis Ababa University

College of Natural and Computational Sciences



School of Information Science

**Identifying Ethiopian National Mining Cadastre System (ENMCS) Post
Implementation Success Factors: The Case of Ministry of Mines of Ethiopia**

By

Fitsum Assefa

June, 2021

DECLARATION

I, Fitsum Assefa, declare that this work entitled “**Identifying Ethiopian National Mining Cadastre System (ENMCS) Post Implementation Success Factors: The Case of Ministry of Mines of Ethiopia**” is the outcome of my own effort and study and that all sources of materials used for the study have been duly acknowledged.

I have produced it independently except for the guidance and suggestions of my research advisor. This study has not been submitted for any degree in this University or any other University. It is offered for the partial fulfillment of the degree of Masters of Science in Information Systems.

By: Fitsum Assefa

Signature _____

Date _____

Advisor: Tibebe Beshah (PhD)

Signature _____

Date _____

**Ethiopian National Mining Cadastre System (ENMCS) Post Implementation
Success Factors:
The Case of Ministry of Mines of Ethiopia and Regional Mines Bureaus**

By

Fitsum Assefa

June, 2021

Name and signature of Members of the Examining Board

Name	Title	Signature	Date
_____	Chairperson	_____	_____
_____	Advisor	_____	_____
_____	Examiner	_____	_____
_____	Examiner	_____	_____

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Abstract

With the aim of bringing transparency and efficiency to its mining sector, Ethiopia implemented a web based mineral licensing and administration system named FlexiCadastre with the support of the world bank back in 2008. However, the post implementation utilization of the FlexiCadastre is inconsistent between federal and regional mineral licensing bureaus and did not bring the intended business benefit. The strategic direction put forward for the mining sector of Ethiopia in the second growth and transformation plan (GTPII) is attracting foreign direct investment to the mining sector. In an attempt to revive a decline in foreign applicants Ministry of Mines and Petroleum (MoMP) upgraded FlexiCadastre System to Ethiopian National Mining Cadastre System (ENMCS) with an e-government portal to improve the mineral licensing and administration's transparency and efficiency which in turn is believed to boost investor confidence. The ENMCS has gone live in December 2019. However, with no empirical study conducted on the post implementation challenges that resulted in the underutilization of the FlexiCadastre and the scarcity of studies on land administration system post implementation critical success factors will makes it difficult to objectively identify factors that will improve the post implementation utilization of the ENMCS.

The objective of this study is to identify technical, organizational and operational factors that affect the post implementation utilization of ENMCS and based on the identified issues to propose a high level ENMCS post implementation utilization improvement organizational guide. This research is a case study where a combination of quantitative and qualitative methods has been employed to collect and analyze data. The study's research model is proposed after extensive literature review on land administration system (LAS) and ERP post implementation related literatures. The proposed research model that is based on the literature review indicated three major themes; Technical, Organizational and Operational themes that affect the post implementation utilization of the ENMCS. A survey questionnaire that is adopted from literatures and contextualized to the case of ENMCS to quantitatively measure the constructs under the three themes is administered to the population of the study that is 73 federal and regional level ENMCS users. To triangulate the quantitative method findings of the study a qualitative method is applied by administering semi-structured interviews with purposively selected two federal and three regional mineral licensing and administration directors.

Descriptive and inferential analysis has been conducted on the quantitative data of the study using SPSS. The interview findings of the study are arranged into major themes and narrated. The descriptive statistics of the study revealed that 50% of the respondents disagreed on top management having a discussion with them on the impact of ENMCS on their work. The vast majority of survey respondents, 89%, disagreed being made aware of ENMCS upgrades and unavailability through email. The inferential statistics revealed that organizational and operational issues to have a significant positive relationship with the ENMCS perceived usefulness and overall satisfaction of using the ENMCS. The interview findings triangulate the descriptive and inferential statistics findings of the study as they revealed the organizational theme construct of top management commitment having a crosscutting impact on all the constructs of the technical, organizational operational themes. The organizational guide is proposed based on the findings of the study for the constructs that are critical for improving the post implementation utilization of the ENMCS using the people, process and technology concept as a guide.

Keywords: ENMCS, Cadaster, Land Administration System (LAS) and ENMCS Post implementation utilization.

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List of Acronyms

ANRS - Amhara Region's land administration system

ENMCS - Ethiopian National Mining Cadastre System

FDI - Foreign Direct Investment

GIS - Geographic Information System

GTP II - Second Growth and Transformation Plan

LADM - Land Administration Domain Model

LAS - Land Administration System

MoMP - Ministry of Mines and Petroleum

OSS - Open Source Software

OUE - Operational Use evaluation

PoUE - Prior Operational Use evaluation

PPT - People, Process and Technology

ROI - Return on Investment

RRR - Rights, Responsibilities and Restrictions

SDI - Spatial Data Infrastructure

TAM - Technology Acceptance Model

TOE - Technology, Organization and Environment

CHAPTER ONE

Introduction

1.1 Background

Ministry of Mines and Petroleum (MoMP) of Ethiopia implemented a mining cadastre system named FlexiCadastre (developed by a company named spatial dimension in 2008 with the support of world bank) to modernize the mining sector and bring the necessary efficiency and transparency. The FlexiCadastre integrated mineral rights management solution had been implemented centrally at MoMP in Addis Ababa with a real time connection to nine regional state and two city administration mining bureaus. FlexiCadastre was used to issue and administer mineral rights for both Ethiopian national and foreign investors. Mineral rights licenses to foreign companies are issued and administered at the federal level while licenses for Ethiopian nationals are issued and administered at regional mines bureaus. The mining sector was one of the priority sectors for Ethiopia in the second growth and transformation plan (GTP II) with the main strategic direction of attracting foreign direct investment (FDI) (National Planning Commission, 2016) and the FlexiCadastre system was believed to be critical to attract FDI through bringing transparency and efficiency in mineral licensing and administration.

“FlexiCadastre uses a business rule and workflow-centric approach to facilitate the efficient administration of mineral title in multiple jurisdictions, using a web portal for data management and reporting, advanced task management, configurable business logic and best of breed Geographic Information System (GIS) technologies” (Spatial Dimension, 2008). The system is based on a three tier architecture; the data access tier, the business process tier and the presentation tier. The data access tier consists of a set of software components that manage the flow of information to and from the database. Workflows are managed by a set of rules, in the case of Ethiopia the rules are drawn from the mining proclamation and regulation, residing in the business process tier and the presentation tier consists of the user interface components and provides the tools to capture and display the information handled by the data access tier in accordance with the workflows and rules defined in the business process tier (Feast et al., 2006).

During FlexiCadastre’s 11 years’ operational use, its intended benefits of efficiency and transparency to the mining sector were not fully realized as most regional mining bureaus were relying on other standalone systems that created mineral license data silos and manual licensing

procedures to issue and administer mineral licenses. This inconsistency in FlexiCadastre use led to MoMP's federal mineral licensing and administration body issuing licenses to foreign investors that overlaps with licenses that are issued by regional mines bureaus that led to conflicts between license holders. No empirical post implementation evaluation had been conducted on the operational use of FlexiCadastre to identify the challenges that led to its inconsistent use by the federal and regional mines bureaus to propose solutions to improve the system's utilization.

MoMP upgraded FlexiCadastre System to Ethiopian National Mining Cadastre System (ENMCS) with an e-government portal in an attempt to improve the mineral licensing and administration transparency, efficiency and boost investor confidence. ENMCS has gone live in December 2019 and enable new applicants and existing license holders to get various services such as applying for new license, paying application fee, paying land rent, submitting annual reports etc. online. The researcher believes an empirical study on the post implementation use of ENMCS will enable to identify factors that affect the systems utilization at the regional and federal mines bureaus.

As defined by Willcocks (1992) information system evaluation is “the process of establishing the worth of IT/IS projects to the organization by quantitative and/or qualitative techniques”. Al-Yaseen et al. (2010) advocates for a continuous qualitative and quantitative evaluation of systems at different stages in the full life cycle of an IS project and at different points in time for the sake of explicitly identifying the impact of a system. There are two kinds of IS evaluation a ‘Prior Operational Use evaluation’ (PoUe), that is conducted at the development stage of a system to forecast its business value based on projected data and ‘Operational Use evaluation’ (OUe) based on real data to assess the realization of the system's promised business value (Eldaib et al.,2003). This study focuses on the OUe of the ENMCS, as the system has been in operational use by the federal and regional mines bureaus since December 2019.

Pera and Withanage (2008) stated that past studies have focused on business systems' choice, design and development however there are not much studies related to post implementation planning which is vital for getting the desired business value from implemented systems. So far much of the focus on IS post implementation evaluation is on technical factors that explains only 20% of IS failures and technical evaluations are often failed to explain why

usable and useful systems are often did not bring the promised value to organizations (Westbrook et al., 2004). A comprehensive evaluation approach that takes into account not only technical factors but also organizational and social factors are necessary to identify variables that affect the use of IS (Westbrook et al., 2004).

To identify challenges and success factors of ENMCS operational use at the federal and regional level that will help design the interventions necessary to get the desired business value it is important to conduct ENMCS post implementation evaluation. Therefore, this study is geared towards identifying the technical, operational and organizational factors that affect the post implementation utilization of the ENMCS and proposing a high level post implementation utilization improvement organizational guide for improving the consistent utilization of the system by federal and regional mines bureaus' ENMCS production site users.

1.2 Statement of the Problem

In order to improve the transparency and efficiency of mineral licensing and administration with the aim of attracting foreign direct investment to the mining sector of Ethiopia, the world bank funded a Cadastre Data Management System named FlexiCadastre in 2008 (Spatial Dimension, 2008). FlexiCadastre, an integrated mineral rights management solution has been implemented centrally at Ministry of Mines and Petroleum (MoMP) with real time connection to the 9 regional state and 2 city administration mine bureaus.

However, after the FlexiCadastre system go-live the promised benefits of the system were not fully realized as regional mining bureaus were not consistently using the system to issue mineral rights which leads to issuing overlapping licenses to foreign applicants by MoMP with the licenses issued to Ethiopian nationals by the regional mining bureaus. No survey had been conducted to assess the utilization of the FlexiCadastre at the federal and regional mines bureaus to address the factors that led to the system's inconsistent use. Justifying the adoption of information systems is a long standing problem as the business value obtained is falling short of the investment made and this makes the evaluation of Information systems critical (Al-Yaseen et al., 2010).

After a decline in foreign applicants for mineral rights, MoMP made an attempt to revive foreign direct investment for the mining sector primarily through seeking an upgrade to the

FlexiCadastre System to Ethiopian National Mining Cadastre System (ENMCS) that has an e-government portal that enables customers to conduct their mineral rights related businesses online.

Even though FlexiCadastre post implementation utilization inconsistency is not the only reason for a decline in FDI, the scope of this study is limited to post operational use evaluation of the ENMCS and the finding could be used as an input to identify other factors such as political stability, corruption, infrastructure etc. as other variables that may have an impact for FDI decline. The ENMCS which has gone live in December 2019 is aimed to boost investor confidence through making the mining sector transparent by applying first come first served rule and allowing applicants to make online application. To identify factors that impact the utilization of the ENMCS it is necessary to evaluate its use at federal and regional mines bureaus.

Several large scale land administration system projects that are funded by international aid and funding institutions failed in Africa (Deininger et al., 2008). Despite the fact that 16 African countries implemented a national mining cadastre system, a post implementation study that show the challenges and critical success factors with the context of developing countries has not been conducted (Trimble, 2018). “There is a surprising scarcity of research into the uses and users of cadastral data” (Krigsholm et al., 2018). Lemman et al. (2015) stressed the urgent need to learn from progressive land administration systems to come up with working and individualized LAS in Africa.

Taddele (2015) states that achieving a successful go-live is just one part of a successful implementation and harnessing the promised benefits of a system requires a careful post implementation planning and management. To justify the cost of a system adoption with actual data post implementation evaluation is necessary (Al-Yaseen et al., 2010). The post implementation success of information systems can either be measured through financial matrices like return on investment (ROI) or can be measured indirectly through evaluating users’ satisfaction of the implemented system as satisfied users will effectively use the implemented system that will enable the implementing organization realize the intended business value from the system (DeLone & McLean, 2002). Perceived usefulness that is defined as the extent to which a person believes that using a system would enhance job performance affects both pre and post-implementation of IT systems (Bhattacharjee and Premkumar, 2004).

The success of information systems cannot solely be determined by technical factors alone and a more comprehensive approach that takes into account social, organizational, cultural and cognitive factors is necessary in evaluating the success of an information system (Westbrook et al., 2004). Technical, organizational and operational issues that affect the post implementation utilization of the upgraded ENMCS and its predecessor FlexiCadaastre system has not been studied for MoMP and regional mining bureaus of Ethiopia. Studying the technical, organizational and operational issues that affect the post implementation utilization of ENMCS and its relation with the overall satisfaction & perceived usefulness of the system at the federal and regional level will help in identifying factors under each theme that affect the utilization of the ENMCS to bring the desired business value. In addition, this study helps to empirically justify whether there is a statistically significant difference in the level of user satisfaction between federal and regional ENMCS users. These findings in turn are used to propose a high level post implementation utilization improvement organizational guide which is believed to enable systemic interventions at federal and regional mining bureaus to improve the ENMCS utilization and bring the desired efficiency and transparency to the mining sector of Ethiopia.

This research attempted to identify technical, organizational and operational challenges and success factors of the ENMCS post implementation that influences the utilization of the ENMCS at the federal and regional mines bureaus.

Therefore, this research attempted to answer the following research questions

1. What are the technical, operational and organizational factors that impact the utilization of ENMCS between federal and regional mines bureaus?
2. Is there a significant difference in the level of user satisfaction and perceived usefulness of the ENMCS between federal and regional ENMCS users?
3. Is there a significant direct relationship between the technical, organizational and operational factors that affect ENMCS utilization with the level of user satisfaction and perceived usefulness of the ENMCS?

1.3 Objective of the Study

1.3.1 General Objective

The general objective of the study is to investigate the post implementation factors that affect the ENMCS post implementation system utilization by federal and regional mining bureaus and propose a high level ENMCS post implementation utilization improvement organizational guide.

1.3.2 Specific Objectives

The specific objectives of the research are:

- To assess the level of user satisfaction with the ENMCS
- To identify technical, organizational and operational factors that affect the utilization of ENMCS
- To test whether a significant relationship exists between technical, organizational and operational issues with overall satisfaction of users.
- To test whether a significant relationship exists between technical, organizational and operational issues with perceived usefulness of ENMCS.
- To test whether there exists a significant difference in the overall satisfaction and ENMCS perceived usefulness between regional and federal level users and
- To propose high level post implementation utilization improvement organizational guide.

1.4 Significance of the Study

This study is aimed to contribute towards efficient utilization of ENMCS through proposing a high level post implementation utilization improvement organizational guide, using the findings of technical, operational and organizational factors that affect the system's use and through the review of relevant literatures. The utilization of the organizational guide is believed to guide prioritized interventions to bring the desired optimal ENMCS utilization at the federal and regional mines bureaus which in turn will bring the intended transparency and efficiency in managing mineral rights information in Ethiopia that enables management to make informed decision and attract foreign direct investment.

This study is also aimed to contribute and partly address the under explored user side to land administration system post implementation and the scarcity of literature to guide e-cadastral development and implementation globally as acknowledged by Krigsholm et al. (2018) and Hull & Whital (2013).

1.5 Scope and Limitation of the Study

The mining cadastre system, that is developed by Trimble, is specifically designed to facilitate the efficient administration of mineral titles in multiple jurisdictions by licensing governments and exploration and mining companies in operating their assets across multiple continents. Land administration system development vendors named Trimble, customized the business rules of ENMCS based on the mining proclamation and regulation of Ethiopia. As this study focuses on the post implementation technical, organizational and operational factors of the ENMCS that affects the system's utilization in Ethiopia the findings may not be generalizable to other countries, exploration and mining companies using the mining cadastre system. Moreover, the research model and constructs of the research need also be tested in future studies with a greater population or sample size to test the constructs significant relationship with overall satisfaction and perceived usefulness.

1.6 Organization of the Thesis

This study is organized into six chapters. Chapter one, the current chapter, is an introductory chapter that includes background, statement of the problem, objective of the study, significance of the study and the scope of the study. Chapter two includes literature review from international journals and local studies that covers cadastre based land administration system concepts and post implementation studies on cadastre based land administration systems. In chapter three the research methodology is discussed. Chapter four included data presentation, analysis and interpretation. Chapter five includes discussion of findings along with high level ENMCS post implementation utilization improvement organizational guide. Chapter six, the final chapter, includes conclusions, recommendations and future research directions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

In this chapter scientific researches that discussed the concept of land administration system (LAS), the maturity, implementation and future trends of LAS are reviewed and referred. In addition, LAS post-implementation related literatures are reviewed in the related works section to show the research gap that this study attempted to address.

The articles that are reviewed and referred to understand the theoretical background, implementation options, implementation challenges and post-implementation utilization and critical success factors of LAS are searched from Google, Google Scholar, ELSEVIER, Academia and Emerald Insight databases. The keywords used to search the databases are listed in Table 2.1 below.

Table 2. 1 Keywords used for searching literature

Keywords used for searching LAS related work
Land Administration System
Land Administration System Implementation
Land Administration System Post-Implementation
Land Administration System Post-Implementation Evaluation
Land Administration System utilization
Land Administration System future trends
Cadastre
Mining Cadastre
Cadastre System Implementation
Mining Cadastre post-implementation
IS post implementation evaluation
IS post implementation management framework

2.2 Land Administration System (LAS)

Land administration processes of recording and disseminating information related to the rights, responsibilities and restrictions on the ownership of land and its associated resources catalyze the need for LAS (Dawidowicz A., Żróbek R., 2017). According to Enemark (2009) “Land Administration Systems (LAS) are an important infrastructure, which facilitate the implementation of land policies in both developed and developing countries”. A cadastre is a map of parcels that are digital or digitized from old paper based survey plans and maps that shows how land related information is organized with interconnected roads and other services (Enemark,2009). The cadastre is the core technical engine that enables LAS to control and manage the four core functionalities: land tenure, land value, land use and land development (Dawidowicz A., Żróbek R., 2017).

Enemark (2009) described the four core functionalities of LAS as;

Land tenure: the processes and institutions related to securing access to land and inventing commodities in land, and their allocation, recording and security; cadastral mapping and legal surveys to determine parcel boundaries; creating new properties or altering existing properties; the transfer of property or use from one party to another through sale, lease or credit security; and the management and adjudication of doubts and disputes regarding land rights and parcel boundaries.

Land value: the processes and institutions related to assessment of the value of land and properties; the calculation and gathering of revenues through taxation; and the management and adjudication of land valuation and taxation disputes.

Land use: the processes and institutions related to control of land use through adoption of planning policies and land use regulations at national, regional and local levels; the enforcement of land use regulations; and the management and adjudication of land use conflicts.

Land development: the processes and institutions related to building of new physical infrastructure and utilities; the implementation of construction planning; public acquisition of land; expropriation; change of land use through granting of planning permissions, and building and land use permits; and the distribution of development costs.

Enemark (2004) stated that traditional land administration systems are centered around cadastral activities that are related to land tenure and land information management but modern

land administration systems incorporate all of the four core functions and he proposed a global perspective for land administration as shown in Figure 2.1 below.

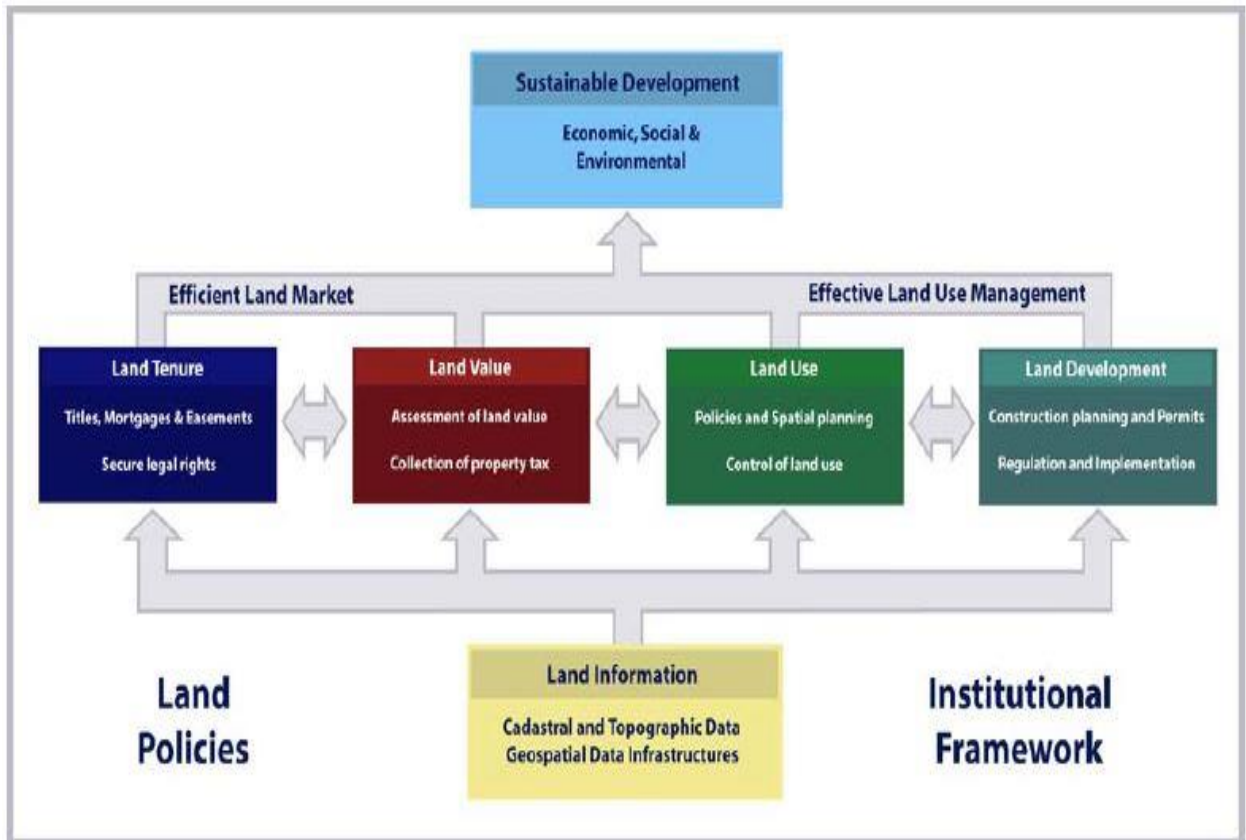


Figure 2. 1- A global land administration perspective (Enemark, 2004)

Many countries are in the process of developing LAS that integrates database of land information systems, land registers, tax registers and land use plans that contain spatial and non-spatial data with the objective of improving the functions of LAS and enable them to provide support for other systems and processes with the ultimate goal of bringing sustainable development for the implementing country (Dawidowicz A., Żróbek R., 2017).

2.2.1 Land Administration Systems level of Maturity

Land administration systems' maturity differ from country to country and countries that are less advanced try to benchmark countries and institutes that are advanced. Van Oosterrom et al. (2009) proposed a maturity level for LAS with four levels and stated that the model forms a kind of a ladder where consecutive levels will help adopting country or institute archive higher value

and efficiency. The proposed four levels of maturity models are; standards, connectivity, integration and network. Oosterrom et al. (2009) described the four levels of maturity for LAS as below;

- Standards – are the foundation that are considered as the basic needs of maturity since they have elements of data modelling and exchange format for LAS.
- Connectivity – After setting standards, LAS adopting organizations or countries can start to make connections that will enable them exchange both spatial and non-spatial information.
- Integration – After making connections organizations or countries forming a kind of land administration infrastructure where all related users from the connected organizations or countries tap into to access and work on spatial information.
- Network – The network level of maturity is where the shift from just accessing and analyzing spatial information to putting the spatial information in context to incorporate and address other social themes like public safety, environmental issues, water management and poverty reduction through semantically translating spatial information.

The maturity model proposed by Oosterrom et al. (2009) is shown in Figure 2.2 below

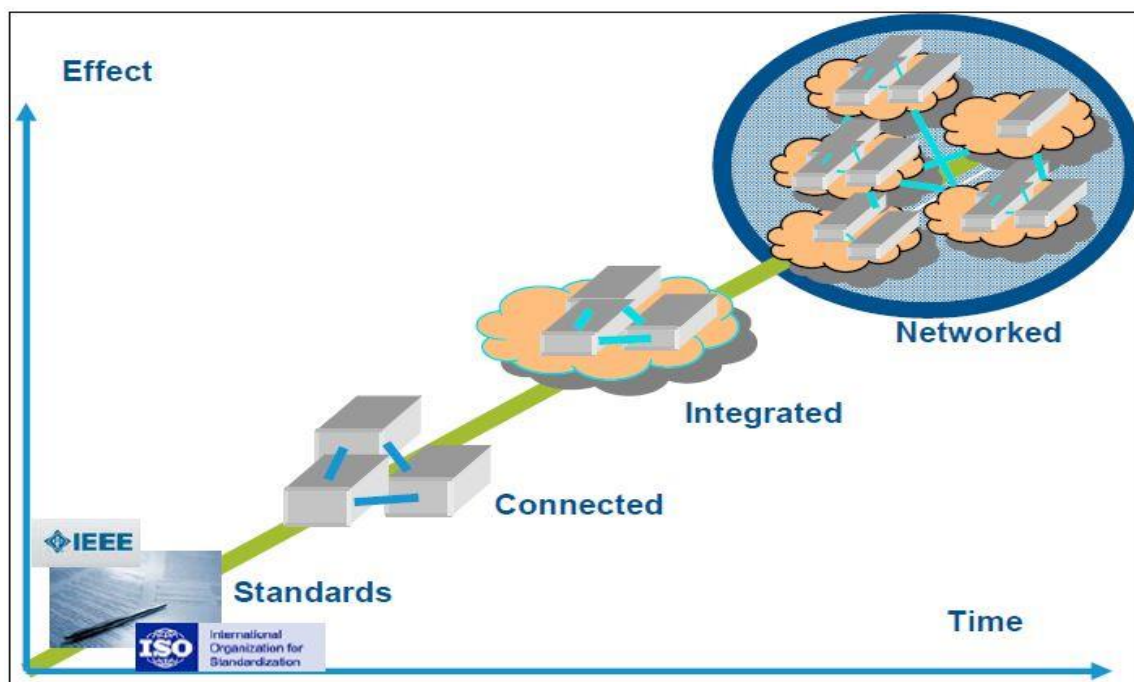


Figure 2. 2 - Land Administration Maturity Model (Oosterrom et al.,2009)

2.2.2 Future trends of LAS

The future of LAS is towards facilitating digital economies and assisting the creation of smart and sustainable cities of the future through re-engineering the two dimensional (2D) digital and paper based parcel representations to three dimensional (3D) representation as land, water, air and underground interests are inherently 3D (Kalogianni et al., 2020). Williamson et al. (2009) stated that the future direction of land administration and cadastral systems will be influenced by: evolving information and communications technology (ICT) and globalization, the dynamic nature of information within LAS, and changes in the use of information.

Krigsholm et al. (2018) in their study of the changes in the use of information, as one of the factors that affect the future direction of LAS, using external users of LAS as a primary data source identified the need for LAS to be: (1) dynamic and responsive, (2) interoperable (easily accessible by other technologies and applications), and (3) coordinated with other public data registers. The challenge for cadastral data provider lies in how this information can be provided reliably, accurately and in real time (Krigsholm et al., 2018).

2.3 LAS Implementation

To implement LAS countries or organizations have the option of choosing either proprietary or open source software options but neither can fully cater for the needs of requesting countries' or organizations' need as both require extensive customization to accommodate the varying land legislation and regulations of the implementing authority (Zein et al., 2015). Proprietary software solutions for LAS that are adopted by developed countries can't be applied directly as there exists great system and administrative incompatibilities (Zein et al., 2015).

Kepes (2013) stated that proprietary software is still winning over open source as implementing organizations want to differentiate themselves in the quality of service they provide and proprietary software developers take advantage of open source software to speed up their development of various customer centric software products. The view of Badea (2016) and Zein (2015) differs from Kepes' (2013) on organization's choice of proprietary over open source software by stating that irrespective of countries' development status they can use open source solutions to implement their land administration system as the main functions of LAS can be developed through collaboration and improved by an interested community which will reduce

the total cost of ownership of an LAS. When it comes to seeking out a software solution the question should not be whether to go for free or paid solutions rather one should ask what problem they have at hand, which solution solves it best and what kind of support they need in the long run at a reasonable price as free can be costly in the long run and spending big on proprietary software may not necessarily solve the problem at hand (Backaitis, 2013).

A purely technical IT system solution for land administration will fail if not designed based on a legal foundation, cultural, historical and social background of an implementing country (Zein, 2015). Williamson et al. (2010) stated that four basic ingredients are involved in designing a national LAS:

- The land management paradigm with its core administration functions which helps organizations design, construct and monitor LAS at a technical, organizational, social and legal levels.
- The common process found in every system. In the case LAS these are country specific parameters such as dividing up land, tracking changes or distributing land.
- A tool box approach offering tools and implementation options. The tools are again country specific and can either be general such as land policies or land markets while other tools can be task specific such as those tasks related to land tenure, registration, boundaries etc.
- A role of land administration supporting sustainable development. This fourth ingredient is about determining the tools necessary for handling environmental, economic or social process.

After more than a decade of modeling and building international consensus, international experts came up with a Land Administration Domain Model (LADM), which is a formal international standard ISO 19152 (Lemmen and Oosterom, 2013). A LADM is a very generic reference model and intended to be refined based on adopting country's specific need by selecting classes from LADM and adding country specific attributes (Lemmen and Oosterom, 2013). According to Zein et al. (2015) LADM has two main goals one is serving as an extensible foundation for the development and refinement of land administration systems that are effective and efficient and the second is enabling efficient data exchange and communication between

implementing parties or countries through the utilization of the shared vocabulary implied by LADM.

LADM has four main classes as shown in Figure 2.3 below

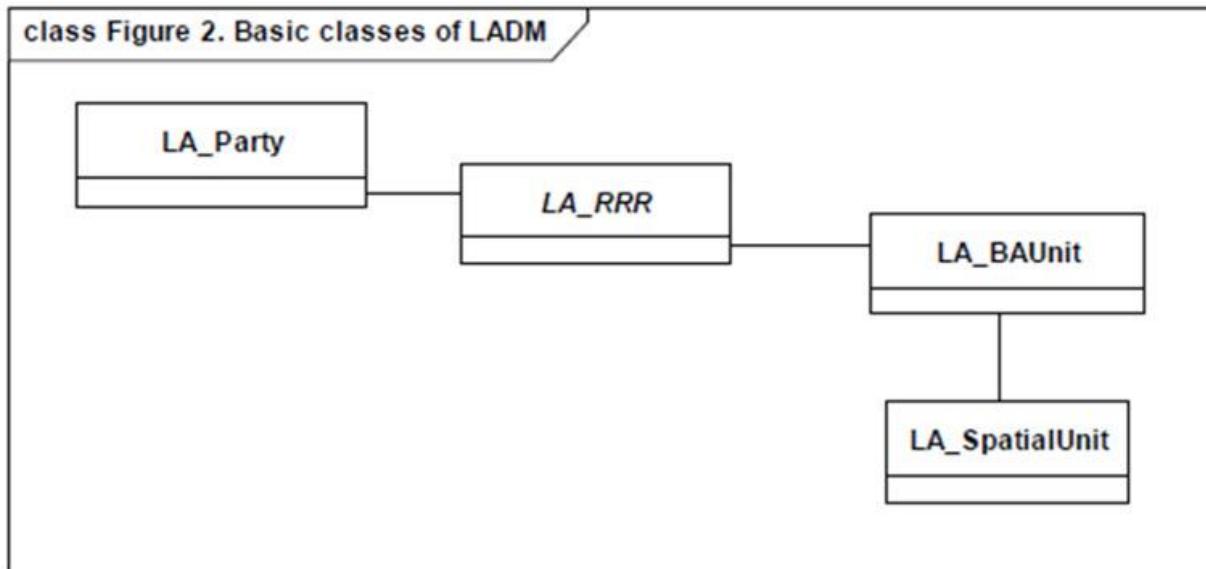


Figure 2. 3- LADM (International Organization for Standardization, 2012)

Zein et al. (2015) described the relationship of the LADM classes as below;

- A party can be an individual person or a legal person and is represented as an LA_Party
- A spatial representation of a parcel in the cadastre is modeled as an LA_Spatial Unit
- A parcel is covered by the legal representation of the parcel and is represented as an LA_BAUnit.
- As parcels and parties are independent objects they are they are connected by one of more of the attributes in the right, restrictions or responsibilities class which is modeled as Land Administration Rights, Responsibilities and Restrictions (LA_RRR).

An onion model for LAS implementation shown in Figure 2.4 below is proposed by a German company for aerial surveys called Hansa Luftbild AG in 2015.

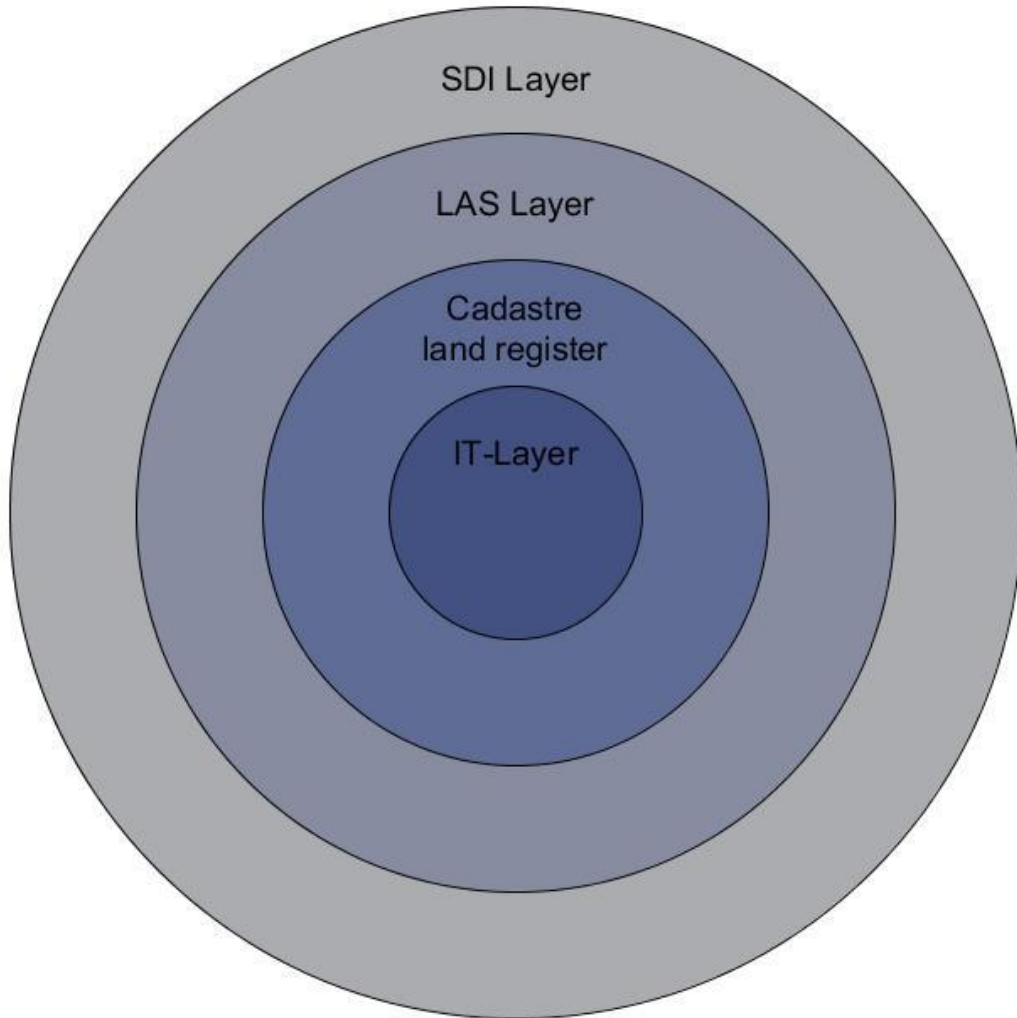


Figure 2. 4 - Layered model of the technical implementation of an LAS (Hansa Luftbild, 2015)

In the above technical implementation model the inner core that represents the IT layer is comprised of database and geographic information system (GIS) components and is completely domain independent. The cadastre layer that comes after the IT layer is where the cadaster and land registration systems that provide general functionality common to all land administration systems reside. The next layer that comes after the cadastre and land register layer is the LAS layer which contains process and models that are specific to the implementing organization or country. The spatial data infrastructure (SDI), which is the last layer of the onion implementation model, contains an interface to services and systems to spatially enabled government processes. Zein et al. (2015) stated that the IT layer and the cadastre land register layers are ideal candidates for an Open Source Software (OSS) implementation as these layers are independent from the

LAS layer above them which is modeled based on the specific process of an LAS implementing country.

LAS development and implementation needs careful consideration and important decision making in choosing open source and proprietary software both of which requires customization to fulfill requirements. Even though the initial cost of developing an LAS based on OSS or proprietary software is equivalent a saving can be made during the life time of the system which is estimated around 25 years, if an implementing country choses a base open source software and opt for a proprietary application software the maintenance fee over the lifetime of the LAS will only be for the application software as the base software will be maintained by the open source community (Zein, 2016).

2.3.1 Ethiopian National Mining Cadastre System (ENMCS)

MoMP of Ethiopia implemented a mineral rights management solution called FlexiCadastre with the support of the world bank back in 2008. FlexiCadastre uses a web portal for data management and reporting, advanced task management and configurable business logic in issuing and administering mineral rights (Feast et al., 2006). “FlexiCadastre is a three tier architecture that separates the system into the data access tier, the business process tier and the presentation tier. The database/s underlie these tiers.” (Feast et al., 2006). The lower level data access tier consists of software components that are used to manage the flow of information to and from the databases, this data access layer arrangement enables the abstraction of the database from the rest of the system and this makes it easy to modify complex workflows that reside in the business process tier and are specific to implementing clients. The high level FlexiCadastre software architecture is shown in the Figure 2.5 below.

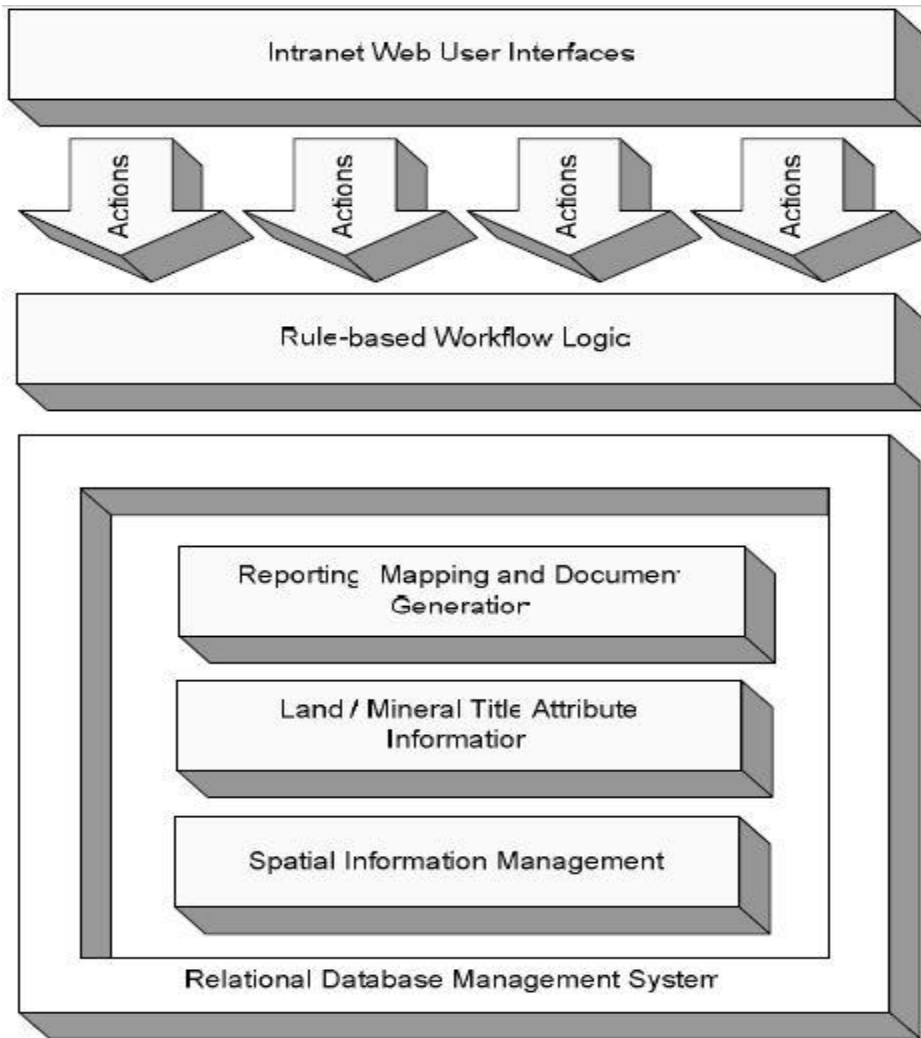


Figure 2. 5- FlexiCadastré System Architecture (Feast et al., 2006)

FlexiCadastré’s centralized database is divided into main data groups that include core data, historical data, spatial data, workflow data, workflow variables and look-up tables (Feast et al., 2006). Figure 2.6 below shows the high level database design of FlexiCadastré.

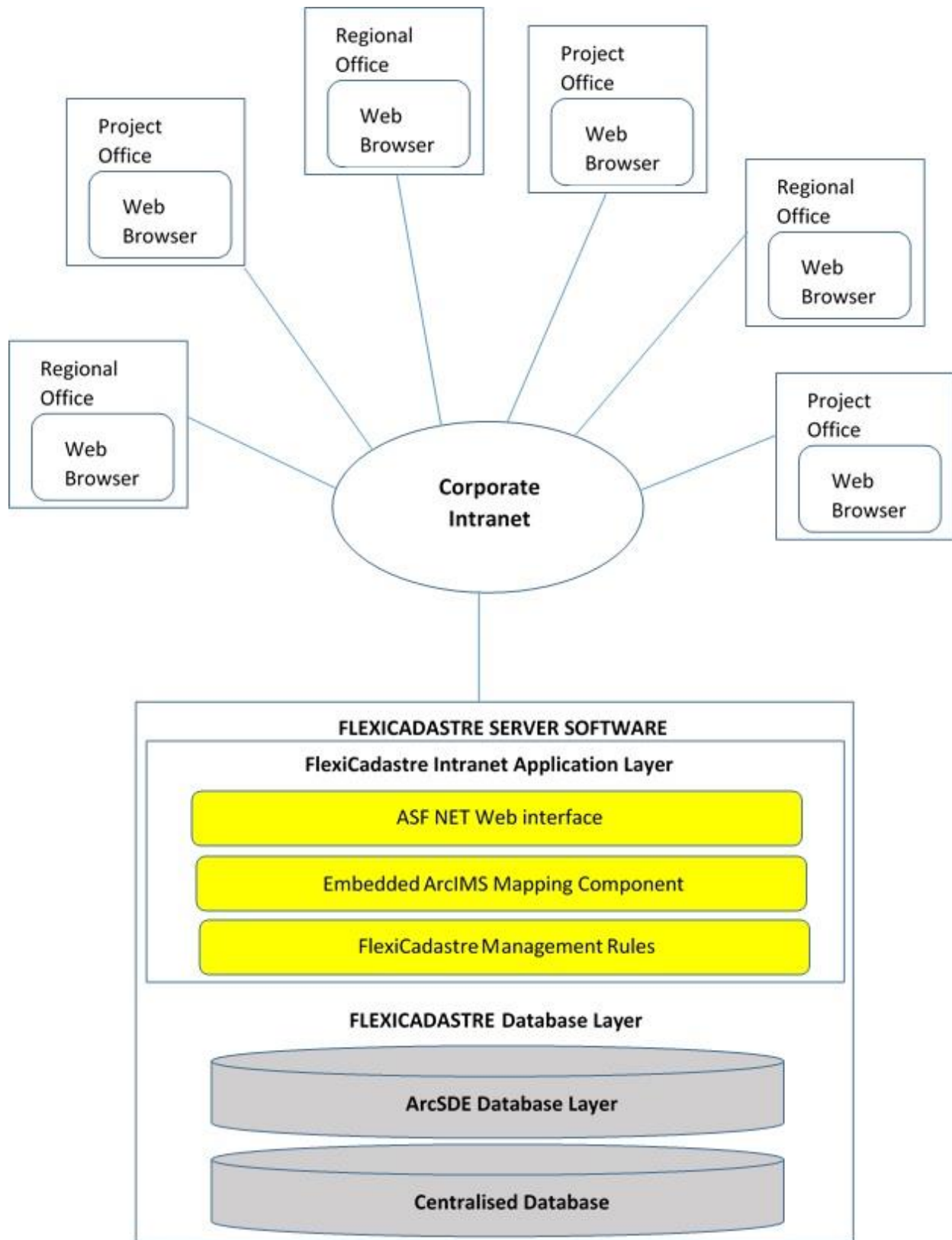


Figure 2. 6- High Level Database Design of Flexi-Cadastre (Feast et al., 2006)

After the implementation of FlexiCadastre the promised benefit of obtaining real time data on the existing mineral rights in Ethiopia to bring the required transparency and efficiency to the mining sector was not realized as the system was underutilized at the federal and regional level due to various technical, operational and organizational issues (Trimble, 2018). The underutilization of the FlexiCadastre coupled with the amendment for the mining operation and mining income tax proclamations in 2013 and the growing demand for e-government portal to conduct mineral rights related businesses online by applicants and license holders, MoMP decided to upgrade FlexiCadastre to Ethiopian National Mining Cadastre System (ENMCS) with an e-government portal (Trimble, 2018).

The upgraded ENMCS with an e-government portal has gone live in December 2019. Trimble (2018) states that the ENMCS has the operational features, capabilities and functions listed below;

- Support all licensing workflows for all the licensing processes as required by Law.
- Ability to store, view and manage all spatial and non-spatial information required for licensing procedures.
- Ability to record, track, manage, alert and report on delays in any workflow.
- Ability to record, track, manage, alert and report on payments required by Law.
- Ability to record, track, manage, alert and report on the reporting requirements specified by Law.
- Ability to record, track, manage, alert and report on the renewals of licenses as per Law.
- Ability to record, track, manage, alert and report on the defaulters as per Law.
- Ability to produce and track the legal documentation (official forms, standard letters, license documents etc) and maps as per Law.
- Ability to provide investors and external stakeholders the ability to interact with MoMP via an online application portal.
- Provide an online map showing all licensing information in real time.
- Provide for multi user access with varying levels of security.
- Provide statistical and analytical reports, including maps and graphs, for management purposes

- Ability to run as an independent system but with the ability to connect to other systems within the Government of Ethiopia as required.

2.4 Related Work

Shibeshi et al. (2015) in their case study for Amhara Region's land administration system (ANRS) systemic evaluation employed both qualitative and quantitative methods with the objective of drawing lessons that will assist in improving the policy, institutional and operational levels of the implemented land administration system in Amhara region and using the findings of the case study contribute for a proper development of individualized progressive land administration systems in the developing world.

Krigsholm et al., (2018) conducted a case study on Finland's Land Information System (FLIS) to shed light on the relatively unexplored user side of cadastral information use and future needs of the users. The qualitative study conducted by administering semi-structured interview to external users of FLIS identified six major themes that have implications for future land administration systems by conducting thematic analysis. The themes are: the streamlining of environmental permit procedures, the integration of public services, three-dimensional land use planning, tightening banking regulations, digital services, and e-government, and coordination among public data agencies.

Ogundipe OY, Opafunso ZO (2016) conducted a survey to evaluate the operation and effectiveness of Nigerian Mining Cadastre System. They assess the effectiveness of the system indirectly by administering a Likert Scale questionnaire on specific functionalities of the mining cadastre systems to mining license holders in Nigeria by using random sampling technique in selecting 100 mineral rights holders. The descriptive statistics of their study suggested that 71% of the respondents agreed that the cadastre system improved the efficiency and transparency of the mineral licensing and administration process in Nigeria.

A study conducted by Shirzad et al. (2014) discussed a framework for developing an exploration and mining cadaster system to address the inaccessibility of a model for systems with similar duties as a mining cadaster system through proposing a model for Exploration and Mining Cadaster System (EMCS) for Iran. The proposed EMCS model by Shirzad et al. (2014) has three main sets of classes with sub classes that enable the issuance and administration of exploration and exploitation licenses; register object, activity license and person.

The EMCS that was designed using a Unified Modeling Language (UML) and turned into a web based application using the open geospatial consortium (OGC) models; enables online registration and application, shortens mineral rights application process and reduces errors in issuing and administering mineral rights which in turn will bring transparency, reduce bureaucracy and prevent administrative corruption (Shirzad et al., 2014). Despite the challenges in modeling, architecture software development and implementation of the EMCS due to the organizations that needs to be part of the system, the successful deployment of the EMCS is believed to increase the investment in the mining sector of Iran (Shirzad et al., 2014). This current study on identifying ENMCS post-implementation success factors attempts to identify the technical, organizational and operational factors that affect the utilization of a mining cadaster system in Ethiopia and differs from Shirzad et al. (2014) work that focusses on modeling a mining cadaster system for Iran.

To overcome the challenges of overlapping land rights, right of construction, right of use and compensation, cadaster systems for natural resource management and other land use management needs to be realized in Tanzania (Hernandez, 2003). Tanzanian's 1997 mineral policy "defined a vision for 25-30 years based on a well-organized private sector; a large and small-scale mining industry conducted in a safe and environmentally sound manner and contributing in excess of 10% of the GDP" and this ambitious vision is expected to be reached through; through ensuring transparency and fairness by applying first come first served rule, ensuring exclusivity on mineral rights licenses and harmonizing the Tanzanian's Mining act with other statutes administrated by other institutions (Hernandez, 2003). Even though it is not the scope of this current study to investigate the harmonization between the various land polices of Ethiopia with the Ethiopian Mining proclamation, which the ENMCS is based on, it could be a potential future research direction to propose solutions on the challenges of objectively determining compensations and other land use management issues.

A 2014 study conducted on the mining cadaster system capacity of Guinee by Tetra Tech for the United States Agency for International Development (USAID) revealed the inadequacy of the existing system to manage large scale and artisanal mineral rights, the challenge in the organizational structure and the skill gap to administer a web based mineral rights administration system. The Tetra Tech found that a portal used to display the mineral rights holders of Guinee

was not location enabled and the location based mineral rights data is maintained by separate organizational division units for large scale mineral rights holders and for Artisanal and Small Scale Mineral (ASM) rights holders on computers with stand-alone ArcGIS application. Based on the study findings, Freudenberger and Harvey (2014) suggested prior to a planned web based cadaster deployment in 2015 for the ASM mineral rights to be digitized and made ready for data migration, for the organizational structure and the skill gap to work on the web based system to be addressed. This current study on ENMCS post implementation found data quality improvement construct of the operational theme to have a significant positive relationship with user satisfaction and users' perceived usefulness of the ENMCS and this is mainly due to the challenge of migrating mineral rights that are issued prior to ENMCS go-live.

2.5 Research Gap

Even though there are many studies conducted on ERP post-implementation critical success factors, only few studies had been conducted on LAS post implementation. As Kirgsholm et al. (2018) puts it “there is a surprising scarcity of research into the uses and users of cadastral systems”. Often useful and usable land administration systems that are realized through significant investment have failed in Africa (Deininger et al., 2008). Therefore, this research attempted to identify the technical, organizational and operational issues that affect the ENMCS post-implementation utilization, the findings of which will contribute towards addressing the scarcity of research on the uses and users of cadasteral systems and may also provide input to reduce the failure of land administration systems in Africa after their development through a huge investment. Moreover, the gaps from the related works that are addressed through this research are discussed in the paragraphs below.

In the related works discussed in section 2.4 above there are research gaps such as inconsistency in the sampling technique and analysis of results in Ogundipe OY, Opafunso ZO (2016) work where random sampling technique is used and in the analysis of findings and discussion session it is claimed that the selected survey respondents as experts in managing their mineral rights which can only be claimed through purposive sampling and this may introduce bias on the research findings. The study by Kirgsholm et al. (2018) has limitations with regards to selecting interviewees that only represented a subset of external user groups which makes the study findings partial and susceptible to bias as a complimentary method such as survey to reach

out a representative sample of a population to draw a justifiable conclusion. The work of Shibeshi et al. (2015) on Amhara Region's land administration system (ANRS) used expert panels and group discussions as qualitative data gathering technique which has a tendency to introduce biases if more vocal senior experts dominate the sessions and they only conduct descriptive analysis in deducing the status of the specific tasks of ANRS as "Very Good" without conducting inferential analysis to show a statistical significance.

In addition to the gaps of sampling technique, data analysis technique and suitability of the methodology, the related works discussed in section 2.4 used an indirect method to measure implemented LAS's efficient utilization through assessing the satisfaction level of service receivers. This thesis research attempted to study factors that affect the post implementation utilization of an LAS in the context of Ethiopia using the direct users of the ENMCS as data sources. The thesis research identified and analyzed the technical, organizational and operational factors that affects the overall satisfaction of the ENMCS internal users, which ultimately affects the systems utilization to bring the desired impact of efficiency and transparency. The result of the qualitative and quantitative data collected and analyzed for this study is used as an input for the proposed post-implementation management framework for the ENMCS.

CHAPTER THREE

Research Methodology

3.1 Overview

In this chapter the methodology that is used to achieve the objective of the research, which is identifying Ethiopian National Mining Cadastre System (ENMCS) post-implementation technical, operational and organizational issues that affect the post-implementation utilization of the ENMCS, is discussed. In addition, the level of user satisfaction and perceived usefulness of the system and their relationship with the issues that affect the post-implementation utilization of ENMCS is discussed and modeled. The general approach of the research, research design, data source, data collection methods, data analysis instrument & technique and validation & evaluation methods are discussed in the consecutive subsections of this chapter.

3.2 General Research Approach

This study is a case study where mixed methods research that combines both qualitative and quantitative methods of data collection and analysis is used to answer the research questions. Creswell (2009) stated that more insight can be gained from employing both quantitative and qualitative methods than using either of them separately. Moreover, their combined use provides an expanded understanding of the research problem. Yin (2003) stated that “a case study is a preferred technique when compared to other techniques in a situation when (1) the main research questions are “how” or “why” questions (2) a researcher has little or no control over the behavioral events and (3) the focus of a study is a contemporary (as opposed to entirely historical) phenomenon”. This current study fulfils criteria (2) and (3) of Yin (2003) suggestion for preferring a case study and partially address criteria one as one of the research questions tries to assess how technical, operational and organizational issues that affect ENMCS post-implementation utilization relate with overall user satisfaction with the system.

3.3 Research Design

“A case study method explores a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information and reports a case description and case themes” (Creswell, 2013, as cited in Gustafsson, 2017). It is stated that case studies are bounded by time, space and physical boundaries of the case (Cousin, 2009; Yin, 2009; Merriam, 2009 as cited in Obeng 2015). This study as it studies the ENMCS in Ethiopia is bounded geographically, in its aspect that it investigates the post implementation utilization of the ENMCS at the federal and regional level and compares the level of user satisfaction between the two, the study can be considered as a multiple case study. Multiple source of information is used to collect qualitative and quantitative data in identifying themes and reporting them as stated in Creswell (2013) definition of a case study.

MoMP and Regional mining bureaus of Ethiopia are selected for the case study as they both used the web based back office only FlexiCadastre System since 2008 and they are currently using the upgraded ENMCS with both back office production site for mineral licensing and administration officers to issue and administer mining license and an e-government portal to be used by mineral rights holders and new applicants since December 2019.

Grant & Ngwenyama (2003) stated that action research guides the critical analysis of a problem situation and provide a theoretical framework for intervention into the organization under study. Action research has practical problem solving orientation and ability to expand scientific knowledge moreover it has been successfully applied in information system projects (Nunamaker et al., 1991; Mathiassen, 1997; Vidgen et al., 1997; Baskerville & Pries-Heje, 1999, as cited in Grant & Ngwenyama, 2003). As this study used the findings from the quantitative and qualitative data analysis and interpretation and proposed an ENMCS post-implementation management framework it has an attribute of an action research.

“In qualitative methods the intent is to explore the complex set of factors surrounding a central phenomenon and present the varied perspectives and meanings that participants hold” (Creswell, 2013). Central questions to explore the issues that affect the post-implementation utilization of the ENMCS at the federal and regional mining bureaus are prepared and conducted. Interview findings from the exploratory central questions used to refine the Likert items of the

survey questionnaire. The survey findings together with the exploratory interview findings are used as an input to design the semi-structured interview questions, the findings of which complement both the exploratory interview and survey findings.

Quantitative methods can be used for examining the relationships between variables to answering research questions and hypotheses through surveys and experiments (Creswell, 2013). In this case study, a survey is conducted through a self-administered questionnaire using Google Forms for regional and paper based for federal mineral licensing and administration officers, with questionnaire items partially adopted from literatures and customized from an input gathered with the exploratory interview, to investigate technical, operational and organizational issues that affect the post-implementation utilization of the ENMCS. The survey also assessed the overall satisfaction of ENMCS users and perceived usefulness of the system and analyzed their relationship with the technical, operational and organizational issues that affect the post-implementation utilization of the ENMCS. In addition, the difference in the level of overall satisfaction between federal and regional ENMCS users is analyzed. To triangulate the quantitative method findings semi-structured interview and document analysis is conducted.

Based on the finding of the qualitative and quantitative data analysis and interpretation a high level ENMCS post implementation utilization improvement organizational guide is proposed that is believed to improve ENMCS utilization at the federal and regional mining bureaus is proposed.

3.3.1 Research Model

The literature review conducted in chapter two revealed that; technical, operational and organizational themes affect post implementation utilization of information systems. Williamson et al. (2009) stated that “land administration systems cannot be fully understood, built or reformed unless the core process that deal with operational functions are well understood” this emphasizes the importance of the operational theme in post-implementation evaluation as understanding and reforming LAS requires an understanding of operational functions. According to Mitchel et al. (2008) various approaches were undertaken to evaluate and compare the performance of LAS in developing countries and many of the approaches focused only on investigating the efficiency of land administration processes and the capacity of institutions. This

observation by Mitchel et al. (2008) showed the importance of both operational and organizational themes in evaluating LAS post-implementation or operational use.

The model of the research is mainly adopted from five research studies with modifications to suite ENMCS post-implementation context. The technology, organization and environment (TOE) model has been used to explain the adoption of inter-organizational systems (Grover,1993; Mishra et al., 2007 as cited in Baker, 2011), open systems (Chau and Tam,1997, as cited in Baker, 2011), enterprise systems (Ramdani et al., 2009, as cited in Baker, 2011), and a broad spectrum of general IS applications (Thong, 1999, as cited in Baker, 2011). Kouki et al. (2009) identified three independent contexts: (1) A technological context with constructs of ERP attributes and ERP expertise (2) Organizational context with constructs of top management support, strategic alignment, user involvement, absorptive capacity and compensation and reward system and (3) Environmental context with constructs institutional pressure, vendor support and consultants' effectiveness that affect the independent variable ERP assimilation. Taddele (2015) adopted technological and organizational contexts from Kouki et al. (2009) and an operational theme as three independent factors that affect the ERP post-implementation success at Ethiopian Airlines.

Sam-Okomgboeso et al. (2011) used technology acceptance model (TAM) developed by Davis (1989). Perceived usefulness and perceived ease of use are identified as major factors that influence attitude, behavioral intention and eventual usage of any Information System (Davis, 1989, as cited in Sam-Okomgboeso et al.,2011). Sam-Okomgboeso et al. (2011) proposed a research framework where organizational support constructs of; training, help desk, user manual, communication as independent variables that affect the dependent variables of perceived usefulness and perceived ease of use. Ismail et al. (2014) conducted an empirical study on effectiveness of ERP systems and their theoretical framework was based on six interdependent dimensions of IS success: information quality, system quality, use, user satisfaction, individual impact and organizational impact identified by Petter, DeLone & McLean (2008). Ismail et al. (2014) proposed information quality, system quality and service quality as three independent variables affecting the dependent variable user satisfaction which in turn affect net-benefit. Xu (2019) studied the relationship between data quality of a system to the perceived usefulness of

the system and the perceived usefulness which in turn affects the users' satisfaction with the system.

Unified theory of acceptance and use of technology (UTAT) model aimed to explain technology acceptance by drawing theories and models from; theory of reasoned action (TRA), the Technology Acceptance Model (TAM), the Motivation Model, the Theory of Planned Behavior (TPB), the model of personal computer utilization, the innovation diffusion theory and the social cognitive theory (Venkatesh et al. 2003 as cited in Thomas et al., 2013). "UTAUT model uses behavioral intention as a predictor of the technology use behavior" (Thomas et al., 2013). In addition to the behavioral intention there are four more constructs that make up the UTAUT model, these are; performance expectancy, effort expectancy, social factors and facilitating conditions (Thomas et al., 2013).

The performance expectancy construct of UTAUT is about individual's perception of performance gain from newly implemented technology and it can be viewed as perceived usefulness of technology (Thomas et al., 2013). In this study perceived usefulness is used as a dependent variable that is affected by technical, organizational and operational constructs. The effort expectancy construct of UTAUT is about ease of use technology (Thomas et al., 2013). Ease of use is one of the attributes of a system quality in DeLone & McLean (2008) IS success model that uses system quality as a predictor variable of overall satisfaction. In this study ease of use of the ENMCS assessed under the ENMCS attributes construct, a predictor variable, of the technical theme. The facilitating condition construct of UTAUT is "the perceived extent to which the organizational and technical infrastructure required for the support of the technologies exist" (Thomas et al., 2013). The organizational enablers are addressed in this study as predictor variables of perceived usefulness and overall satisfaction through constructs under the organizational theme of the proposed research model. The technical theme constructs of User support, vendor support and enabling ICT infrastructure are addressed through interviews.

According to the technology acceptance model by Davis (1989) perceived usefulness affects behavioral intention which in turn affect actual system use. According to the IS success model by DeLone & McLean (2003) system quality, information quality and service quality impacts user satisfaction which in turn have an impact on net organizational benefit. Based on

this proposed models this study theorizes that improved perceived usefulness and overall satisfaction will in turn improve ENMCS post implementation utilization.

This research adopted the constructs from TOE model as independent variables that will address the technological, organizational and operational contexts that affect the dependent variables ENMCS post-implementation success as measured by user satisfaction that is proposed by Petter, DeLone & McLean (2008) and perceived usefulness as a measure of IS success as proposed in the TAM model by Davis (1989). Figure 3.1 below shows the research model of this study.

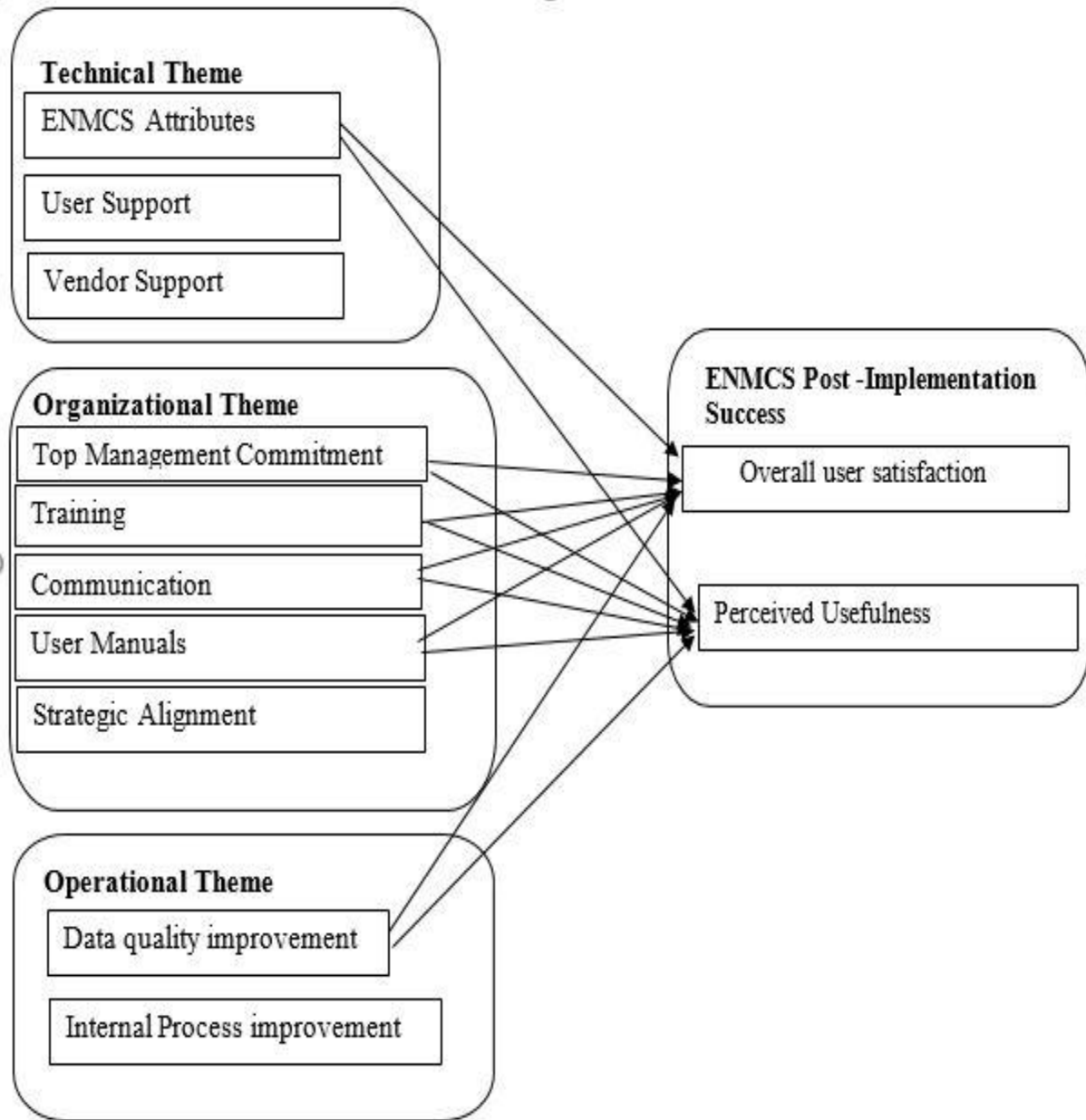


Figure 3. 1- Research Model (adapted from Kouki et al., 2009; Sam-Okomgboeso et al., 2011; Ismail et al., 2014; Taddele, 2015, Xu, 2019)

3.3.1.1 Quantitatively Addressed Constructs and Proposed Hypothesis

Technical theme

ENMCS Attributes – The attributes should include characteristics of an IS that qualifies ENMCS as being a quality system that provides quality information. “A system quality construct is

designed to capture how the system performs from a technical and design perspective” (Sedera et al., 2004 as cited in Ismail et al., 2014). Gable et al. (2008) identified 15 items that can be used to measure system quality, which are: data accuracy, data currency, database contents, ease of use, ease of learning, access, user requirements, system features, system accuracy, flexibility, reliability, efficiency, sophistication, integration and customization. It can be hypothesized that quality systems directly influence overall user satisfaction and perceived usefulness and hence hypothesis 1 (H1) and hypothesis 2 (H2) are hypothesized below. Likert items 1 to 7 under the technical theme of the survey questionnaire are used to capture the ENMCS attributes.

H1: There is a significant direct relationship between ENMCS attributes and overall user satisfaction.

H2: There is a significant direct relationship between ENMCS attributes and ENMCS’s perceived usefulness.

Organizational Theme

Top Management Commitment

To fully gain the benefits of implemented systems top management commitment is an important factor as it plays an important role as management can setup reasonable goals for the system utilization and commits the necessary resources to achieve those goals (Fadellelmoula, 2018). Top management commitment remains an important determinant for sustaining and promoting effective system use (Nah & Delgado, 2006, as cited in Kouki et al., 2009). It can be hypothesized that top management commitment directly affects overall user satisfaction and perceived usefulness as hypothesized in hypothesis 3 (H3) and hypothesis 4 (H4) below. Likert scale items 1 to 4 under the organizational theme of the survey questionnaire are used to capture top management’s commitment towards sustainable and effective ENMCS use at the federal and regional level.

H3: There is a significant direct relationship between top management commitment and overall user satisfaction.

H4: There is a significant direct relationship between top management commitment and ENMCS’s perceived usefulness.

Training

Providing effective training for users will ensure that they have an optimal starting point and they will also obtain a strong foundation and will likely encounter fewer problems in interacting with newly implemented systems (Kushniruk et al., 2009). Lee et al., (2010) in their ERP pre-implementation research found that training had a significant effect on perceived usefulness and ease of use. And hence it can be hypothesized that training directly affects overall user satisfaction and perceived usefulness as hypothesized in hypothesis 5 (H5) and hypothesis 6 (H6) below. Likert scale items 5 to 8 under the organizational theme of the survey questionnaire are used to capture the training construct.

H5: There is a significant direct relationship between training and overall user satisfaction.

H6: There is a significant direct relationship between training and ENMCS's perceived usefulness.

Communication

Dezdar and Ainin (2011) in their research on ERP implementation success factor, identified communication across organization as an important factor for system acceptance. User resistance can be minimized through effective communication which leads to improved system acceptance (Somers et al., 2004). The stress of using a new system can be eased through better communication that positively influences the system's adoption (Lee et al., 2010). And hence it can be hypothesized that communication directly affects overall user satisfaction and perceived usefulness as hypothesized in hypothesis 7 (H7) and hypothesis 8 (H8) below. Likert scale items 9 to 11 under the organizational theme of the survey questionnaire are used to capture the communication construct.

H7: There is a significant direct relationship between communication and overall user satisfaction.

H8: There is a significant direct relationship between communication and ENMCS's perceived usefulness.

User Manuals

User manuals with a specific step by step guide helps users to perform quickly and effectively on a specific task (Keirnan et al, 2002; as cited in Sam-Okomgboeso et al.,2011). To overcome the challenge of periodic updates needed for user manuals it is advisable dynamic information to be included as a link in a master location to ensure changes get reflected in the user’s manual (Scotts, 2005; as cited in Sam-Okomgboeso et al.,2011). User manuals affects the benefits of implemented systems as they impact the current and future use of the system. And hence it can be hypothesized that user manuals directly affects overall user satisfaction and perceived usefulness as hypothesized in hypothesis 9 (H9) and hypothesis 10 (H10) below. Likert scale items 12 to 14 under the organizational theme of the survey questionnaire are used to capture the user manuals construct.

H9: There is a significant direct relationship between user manual and overall user satisfaction.

H10: There is a significant direct relationship between user manual and ENMCS’s perceived usefulness.

Operational Theme

Data quality improvement

“Data quality issues are critical for the successful implementation of any type and size of systems” (Xu, 2019). High quality data is at the core of the system’s ability to produce information for operations, financial reporting and decision making (Xu, 2019). Taddele (2015) described data quality improvement as the reduction in error rate and duplication of data. And hence it can be hypothesized that data quality improvement directly affects overall user satisfaction and perceived usefulness as hypothesized in hypothesis 11 (H11) and hypothesis 12 (H12) below. Likert scale items 1 to 4 under the operational theme of the survey questionnaire are used to capture the data quality improvement construct.

H11: There is a significant direct relationship between data quality improvement and overall user satisfaction.

H12: There is a significant direct relationship between data quality improvement and ENMCS’s perceived usefulness.

Perceived usefulness

Perceived usefulness can be used as an important measure of system acceptance (Xu, 2019). Perceived usefulness can be defined as the extent to which a person believes that using a system would enhance a job performance (Davis, 1989). The improvement of employee's productivity as measured by "the quality improvement of employees' output, the efficiency of employees' decision making using the output of the system, and also the quality of the decisions they make in their work" (Taddele, 2015) can promote the perceived usefulness of the ENMCS. Moreover, cycle time reduction that can be stated as ENMCS's contribution in performing activities related to issuing and administering mineral rights in less time and avoiding overlapping and repetitive tasks as compared to prior ENMCS upgrade can have a positive influence on the perceived usefulness of the ENMCS. Likert scale items 1 to 4 under the perceived usefulness section of the survey questionnaire are used to capture the perceived usefulness of the ENMCS.

User Satisfaction

IS success has been measured through user satisfaction in various studies (DeLone & McLean, 1992; Ives & Olson, 1984; J., 2000; Rushineck & Rushineck, 1986; as cited in Xu, 2019). The overall satisfaction of users in using the ENMCS system is measured with a five-point scale in the survey questionnaire.

The null hypotheses to the proposed hypotheses of the technical, organizational and operational theme constructs is that there is no significant relationship between the constructs (independent variables of the study) and overall user satisfaction & ENMCS Perceived usefulness (dependent variables of the study). If the P-Value of the multiple linear regression output for the proposed 12 hypotheses above is greater than 0.05, that means the null hypotheses cannot be rejected. In addition to the proposed hypotheses, the relationship between the demographic variables of the study and overall user satisfaction & ENMCS perceived usefulness is assessed using the chi-square test for independence. The null hypotheses for the chi-square test for independence is that there is no significant relationship between the demographic variables of the study with the dependent variables of the study. If an asymptotic significance value for the likelihood ratio for the chi-square test for independence is greater than 0.05, that means we cannot reject the null hypothesis.

3.3.1.2 Qualitatively Addressed Constructs of the Thesis Research

An exploratory interview conducted with federal and regional level mineral licensing and administration directors revealed that there is no dedicated IT support for the ENMCS both at the federal and regional level. The ICT directorate at MoMP provide users at federal level with basic internet connectivity, hardware maintenance and proprietary software installations. There is no help desk both at federal and regional level to assist users with their ENMCS related support. Even though the ENMCS is designed to be integrated with other systems and also be able to integrate departments like environmental directorate and finance directorate, the experts have not been granted access to the ENMCS and sensitized on the functionalities of the ENMCS. The required vendor support after the system go-live has been provided by the vendor through the federal mineral licensing directorate director request after accepting support requests from federal and regional ENMCS users.

This led to the user support, vendor support, internal process improvement constructs of the research model to be investigated through semi-structured interviews together with the semi-structured interview questions that are designed to complement the survey findings. The constructs that are addressed through semi-structured interview are discussed below.

ENMCS User Support

IS post-implementation stage being a stage where users learn about the limits of a system, bugs and problems and request for existing functionality adjustments or new functionalities and this makes an internal IT expert crucial during post-implementation to provide continuous system maintenance, fine tuning and user support (Musaji, 2005; Kumar et al., 2003; as cited in Kouki et al., 2007). Characteristics of support personnel such as experience, response time, empathy, friendliness and assurance as service quality measurements and their relationship with user satisfaction has been investigated in various researches and mixed result of significant and non-significant relationships had been observed and hence it is suggested that there is a need for more research to investigate the relationship between the two (Petter et al., 2008). The readiness and support approach of MoMP's ICT directorate with regards to ENMCS related support is assessed.

ENMCS Vendor Support

Vendor support and maintaining the strategic relationship with vendors is vital as technical assistance, software updates, emergency maintenance, user training and other support services, is judged to be very important for successful utilization of systems during post-implementation (Kouki et al., 2007). And hence ENMCS vendor support is addressed in this thesis research.

Strategic Alignment

The main cause of failure to benefit from a system's potential is the alignment gap between IT systems and business strategies as recognized widely in various literatures (Preseley, 2006; Rathman et al., 2005 as cited in Kouki et al., 2007). "Researchers in IT and business strategic alignment field seem to agree that major gains are realized when the IT supports, stimulates and enables the firm's strategy" (Tallon, 2008, as cited in Kouki et al., 2007).

Internal Process improvement

Intra-organizational communication improvements gained after the ENMCS upgrade is addressed through semi-structured interview as the ENMCS users are from one directorate of MoMP, which is mineral licensing and administration directorate and the organizational setup at the regions is similar to that of MoMP. The system's potential to improve internal processes and the organizational setup of MoMP and regions to take advantage of the system's potential is assessed in this thesis research.

3.4 Data Source

The population of the study is MoMP and regional mining bureau mineral licensing and administration officers, directors and deputy directors who are using ENMCS to conduct various mineral rights issuing and administering activities. There are usually a maximum of four mineral licensing and administration officers using ENMCS at the regional mining bureaus reporting to a director and deputy director. The mineral licensing and administration directorate of MoMP has twenty-five mineral licensing and administration officers using ENMCS.

The entire population of ENMCS internal users at the federal and regional level consists of 73 people and hence a census is conducted by administering the questionnaire to collect quantitative data from the population of the study. To complement the quantitative data a semi-structured interview based on the findings of the survey is designed and administered in addition to the semi-structured interview conducted to address user support, vendor support, strategic

alignment and internal process constructs. The qualitative data of the study is collected from a total of 6 federal and regional mineral licensing and administration directors who were part of the project team during the implementation and upgrade of the ENMCS.

3.4.1 Data Collection Instrument

This study employed questionnaire, semi-structured interview and document analysis to collect qualitative and quantitative data that is analyzed to answer the research questions and test the proposed hypotheses.

3.4.1.1 Questionnaire

The questionnaire items are drawn from the reviewed literatures for explaining and supporting the constructs of the study's model as discussed in section 3.3.1.1 and are refined through an exploratory interview with purposively selected directors and senior licensing officers to reflect the issues affecting ENMCS utilization. A 5-point Likert scale measurement for the questionnaire items is used to obtain data from federal and regional ENMCS users. Feedback is obtained on the Likert items of the questionnaire from MoMP ICT director, MoMP mineral licensing and administration director and ENMCS vendor senior business analysts prior to conducting a pilot test to test the reliability and validity of the instrument. After the pilot test an online survey using google forms is administered to regional ENMCS users and a paper based questionnaire is administered to federal ENMCS users.

3.4.1.2 Interview

Qualitative data for this study is collected through administering semi-structured interview questions based on the findings of the quantitative data analysis from the questionnaire and to address constructs under technical, organizational and operational themes of the model that are discussed under section 3.3.1.2 that are judged better addressed through interviews due to the experience and information required to address those constructs is believed to reside at the directors' level. The interview was planned to be conducted with six mineral licensing and administration directors. After conducting five interviews with purposively selected two federal and three regional mineral licensing and administration directors a saturation is reached. Saturation is the point at which "no additional data are being found whereby the researcher can develop properties of the category" (Glaser & Strauss, 1967, as cited in Guest et al., 2020).

A scheduled in-person interview was conducted for 45 minutes on 8 April 2021 with one federal level mineral licensing and administration director and a scheduled 57 minutes long in-person interview is conducted on 20 April 2021 with the second federal mineral licensing and administration director. A schedule was made with the three regional directors to conduct a phone interview and as per the schedule, on 23 April 2021 a total length of 51 minutes of phone interview that ranges from 15 minutes to 21 minutes is conducted.

3.4.1.3 Document analysis

Different documents that are generated by MoMP, specifically the need assessment by regional and federal mining bureaus conducted prior to ENMCS upgrade, ENMCS training outcome evaluation reports, ENMCS training manual, and the 10 years mining sector plan are reviewed with the intent of triangulating the survey finding for ENMCS attributes under the technical theme, the training, user manual and strategic alignment constructs under the organizational theme. The need assessment document is analyzed with the intent of triangulating the survey findings on whether the ENMCS functionalities meet the requirements documented in the need assessment report and also whether the interview findings of the inadequacy of the enabling ICT infrastructure at regional level is captured for informed decision making. The 10 years mining plan is analyzed with the intent to find out whether the ENMCS is strategically aligned to support the business goal put forward.

3.5 Data Analysis and Presentation Method

The collected quantitative data from the online survey is cleaned, coded and loaded on to Statistical Package for Social Science (SPSS) to conduct the descriptive and inferential analysis. The analyzed descriptive data that includes the percentage, frequency and mean is presented using tables and pie-charts. The inferential analysis includes correlation analysis, multiple regression analysis and independent sample t Test to answer the research questions and to test the proposed hypotheses of the study and is presented in tables and discussed.

Open or initial coding is a process of breaking qualitative data into distinct parts and coding them using either through actual standout words (phrases) or using the continuous form of a verb that show an on-going action as a response to situations of the interview participant, from which the researcher examines the parts and compare them for similarities and differences

(Theron, 2015). The qualitative data that is collected from the semi-structured interview is analyzed through open coding and discussed in relation with the quantitative data findings.

3.6 High Level ENMCS post implementation utilization improvement organizational guide

In most organizations across industries a people, process and technology (PPT) model is applied with the aim of improving efficiency in a holistic approach that focused efforts on the three areas (Prodan et al., 2015). The PPT is applied to achieve harmony within an organization and is most often used when deciding whether to purchase or implement new technologies (Simon, 2019). In this study based on the study findings in addition to the PPT, top management commitment is included as a fourth area on the suggested two-dimensional matrix high level ENMCS post implementation utilization improvement organizational guide that is discussed and presented in chapter five, section 5.2. Management functions is also one of the areas proposed by Prodan et al. (2015) to improve the PPT model.

3.7 Reliability and Validity of the Research

Assessing the internal consistency of the scale, the degree to which they are all measuring the same underlying construct, is important (Pallant, 2015). “One of the most commonly used indicators of internal consistency is Cronbach’s alpha coefficient. Ideally, the Cronbach alpha coefficient of a scale should be above .7” (DeVellis 2012; as cited by Pallant, 2015). The reliability of the survey questionnaire is tested on randomly selected federal and regional ENMCS users prior to administering the questionnaire to the population of the study. The Cronbach alpha of the items for measuring the technical theme, the organizational theme and the operational theme are .897, .891 and .864 respectively which are all above the .7 value proposed for testing the reliability of the scale and hence proving the study is reliable.

The content validity of the survey instrument is assessed through expert validation using experts from MoMP ICT directorate and senior business analysts from ENMCS vendors. Construct validity is explored by investigating one construct’s relationship with other constructs, to test whether they are related (convergent validity) or unrelated (discriminant validity) (Pallant, 2015). The construct validity of the instrument is assessed through principal component analysis using SPSS Version 23 and the loading of the items under the constructs of the technical,

organizational and operational themes proved that the items have convergent validity, the analysis result is presented in chapter four under sub section 4.1.7.

CHAPTER FOUR

Data Presentation, Analysis and Discussion

In this chapter, data obtained from the survey, the semi-structure interview and document review are presented, analyzed and discussed based on the specific objectives and in relation with related literatures. The first section, section 4.1 below, and its sub sections incorporates quantitative data presentation, analysis and discussion and the second part, section 4.2, consists of the qualitative data analysis and discussion from the semi-structured interview findings. In the first section, the demographic data of the respondents, the response rate, constructs of the technical, organizational operational themes that impact the utilization of ENMCS at federal and regional mines bureaus, the perceived usefulness of the ENMCS and the level of user satisfaction are presented, analyzed and discussed. The output from the reliability and validity analyses of the survey is presented and discussed in the first section. Moreover, multiple regression analysis and independent sample t-test are conducted to test the proposed hypotheses and to answer the studies research questions. The second section, section 4.2 contains qualitative analysis and discussion of the semi-structured interview findings.

4.1 Quantitative Data Presentation, Analysis and Discussion

4.1.1 Characteristics of the respondents

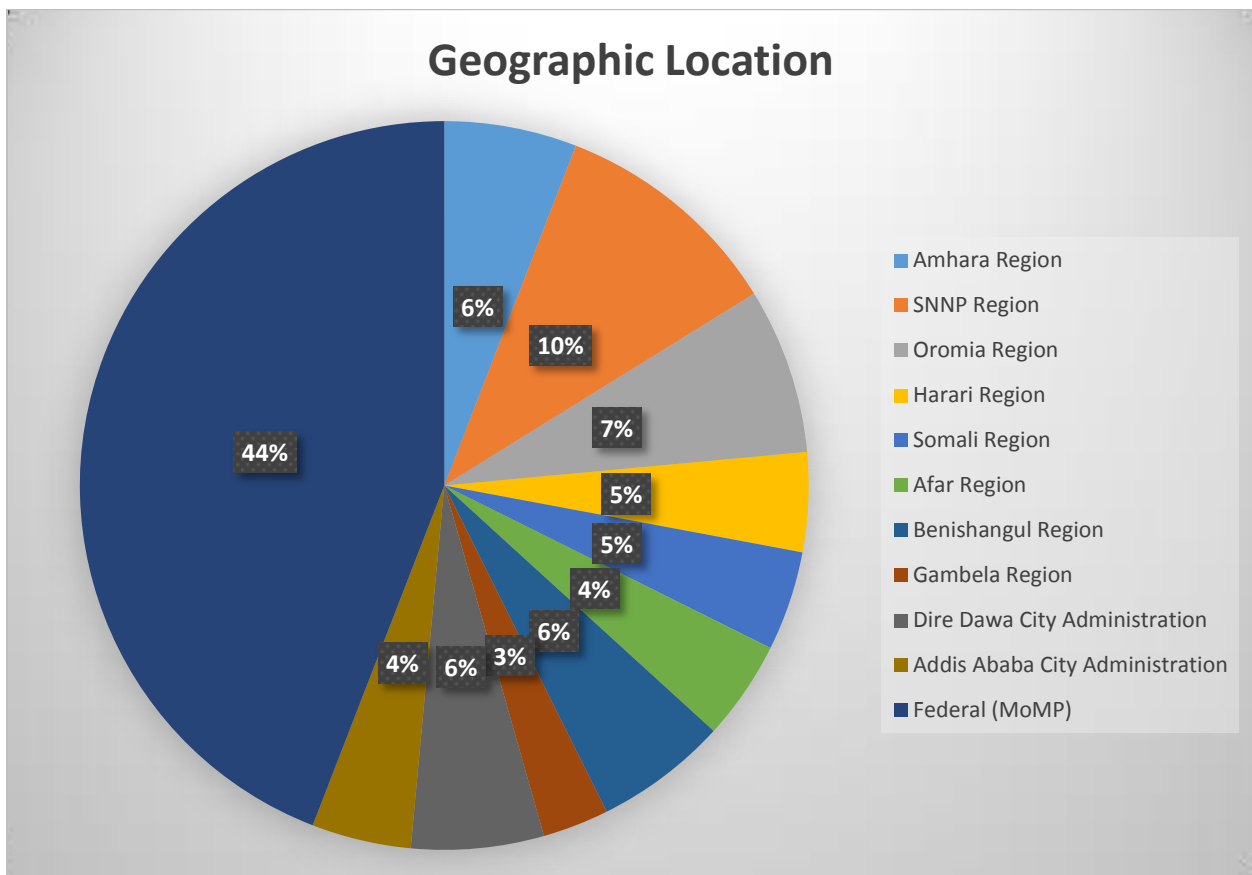
The demographic data collected from the survey respondents include the region, job position, work experience, highest level of education and gender. The significance of the relationship between the respondents' job position, work experience, level of education, geographic location and their overall satisfaction of using the ENMCS as well as their perception

of the ENMCS’s usefulness is discussed under sub section 4.1.8. The characteristics of the survey respondents is discussed from subsection 4.1.1.1 to 4.1.1.5.

4.1.1.1 Distribution of Respondents by Region and Response Rate

The survey questionnaire is administered for 41 regional ENMCS users using google forms and for 32 Federal ENMCS users paper based. Out of the total of 73 survey questionnaire administered to the population of the ENMCS production site users 68 legible responses are obtained. The response rate of the survey is 93.15%. The regional and federal distribution of respondents are shown in Figure 4.1 below.

Figure 4. 1– Distribution of survey respondents from the regions and MoMP.



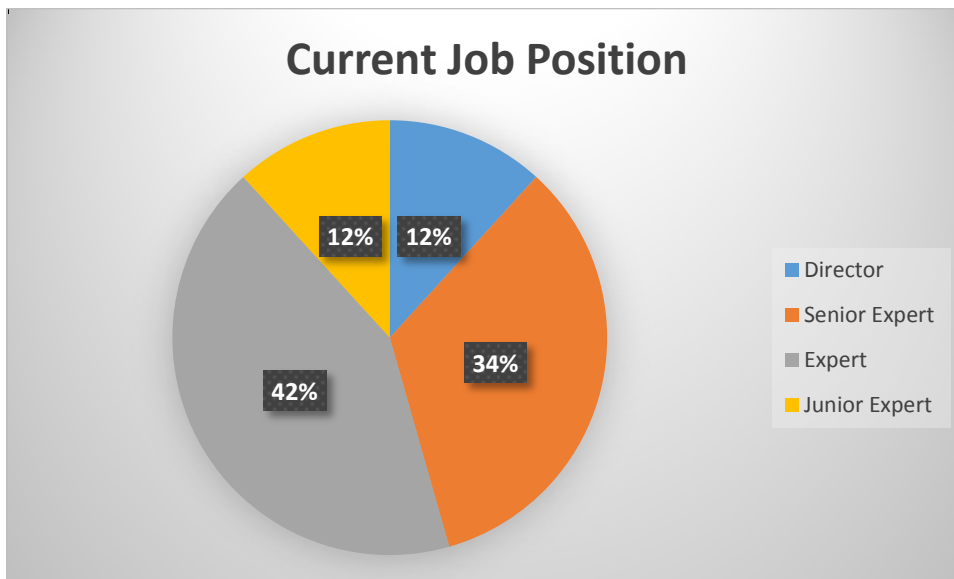
(Source: Own survey, 2021)

4.1.1.2. Distribution of Respondents by job position

The distribution of the respondents with respect to their current position at the federal and regional mining offices is shown in Figure 4.2 below. Accordingly, 29 of the respondents that

constitute 42 % of the total respondents are experts, 23 respondents that constitute 34 % of the total respondents are senior experts, 8 respondents that constitute 12 % are directors and 8 respondents that constitute 12 % of the total respondents are junior experts. The job position distribution showed a balanced senior and junior expertise ideal for assigning senior experts to mentor junior experts on ENMCS functionalities and the rationale behind the functionalities.

Figure 4. 2 Distribution of respondents by job position.



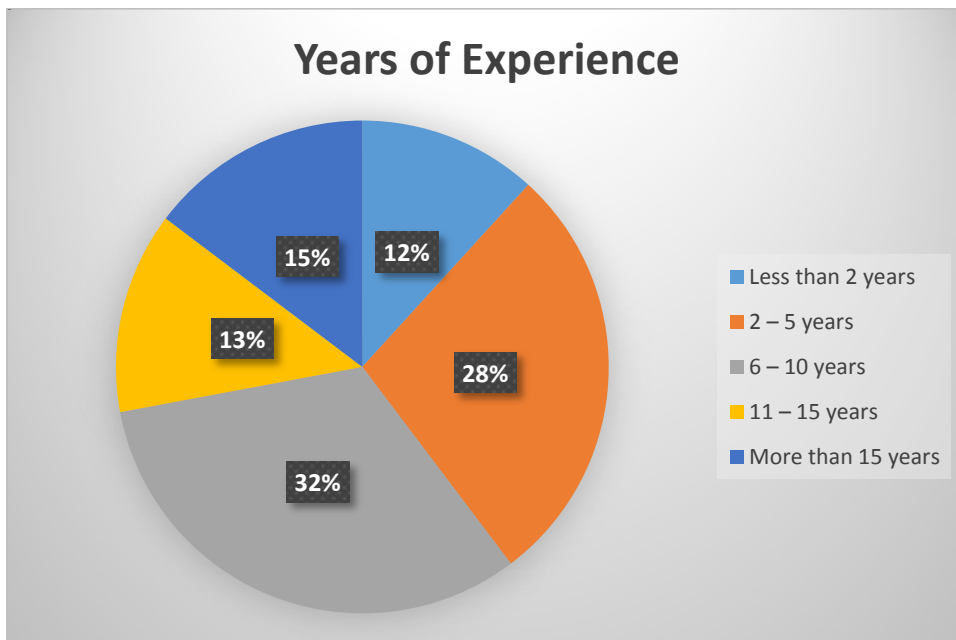
(Source: Own survey, 2021)

4.1.1.3 Distribution of Respondents by years of experience

The distribution of the respondents with respect to their years of experience is shown in Figure 4.3 below. Accordingly, 22 of the respondents that constitute 32 % of the total respondents have 6 to 10 years' experience, 19 of the respondents that constitute 28 % of the total respondents have 2 to 5 years' experience, 9 of the respondents that constitute 13 % of the total respondents have 11 to 15 years' experience, 8 of the respondents that constitute 12 % of the total respondents have less than two years of experience and 10 of the respondents that

constitute 15 % of the total respondents have more than 15 years of experience. Again this distribution showed that there is almost equal number of experts in the less than 2 years of experience category and in the more than 15 years' experience category and with a proper strategy in place, retiring experts can pass their knowledge that promote sustainable ENMCS utilization.

Figure 4. 3 - Distribution of respondents by years of experience.



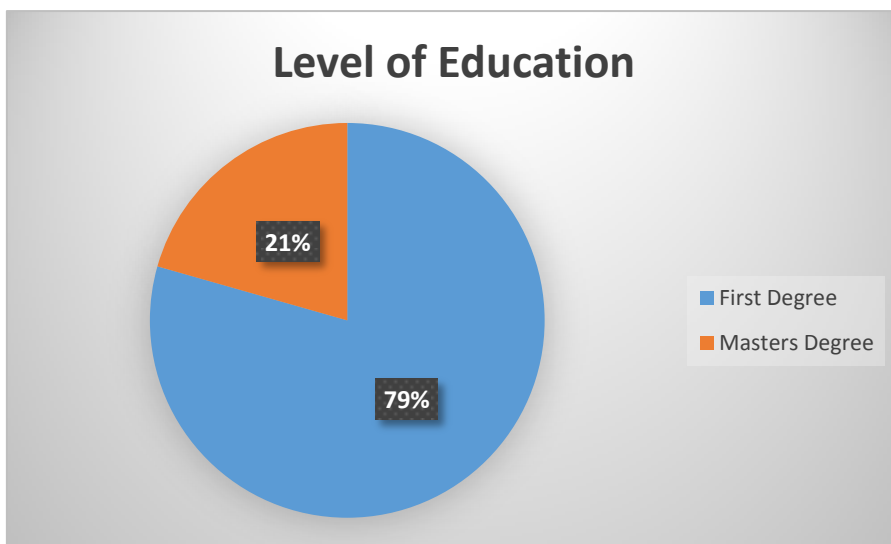
(Source: Own survey, 2021)

4.1.1.4 Distribution of Respondents by Level of Education

The distribution of respondents with respect to their level of experience is shown in Figure 4.4 below. Accordingly, 54 of the respondents that constitute 79 % of the total respondents are First degree holders and 14 of the respondents that constitute 21 % of the total respondents are Master's degree holders. As all the ENMCS users have first degree and above it is safe to assume that they can read and understand the ENMCS user manual which is in English and can also understand classroom structured training conducted in English language which

implies the contribution of the language barrier to inconsistent ENMCS post implementation utilization can be ruled out.

Figure 4. 4- Distribution of respondents by years of experience.

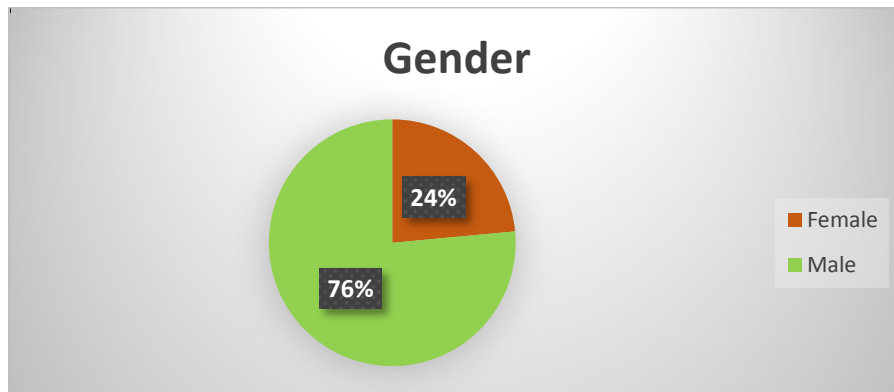


(Source: Own survey, 2021)

4.1.1.5 Distribution of Respondents by Gender

The distribution of respondents with respect to their gender is shown in Figure 4.5 below. Accordingly, 52 of the respondents that constitute 76.4 % of the total respondents are male and 16 of the respondents are female that constitute 23.6 % of the total respondents. The mineral licensing and administration experts are dominantly male this is may be due to the educational background required to join MoMP’s mineral licensing and administration is earth science and mining engineering related disciplines where females are less inclined to join.

Figure 4. 5- Distribution of respondents by gender.



(Source: Own survey, 2021)

4.1.2 ENMCS Post Implementation Utilization Issues

4.1.2.1 ENMCS Post Implementation Utilization Issues: Technical theme

As indicated in the research model, the ENMCS attributes construct is investigated under the technical theme. The external relationship management, IT expertise and user support level constructs of the technical theme are addressed through semi-structured interview with two federal and three regional mineral licensing and administration directors. The qualitative analysis and discussion of the semi-structured interview findings are presented in section 4.2 of this chapter. The survey findings of the ENMCS attributes are discussed below.

ENMCS Attributes

The ENMCS attributes assessed through the survey are; the accuracy and reliability of the information provided by the ENMCS, the currency of information, the fulfillment of functional requirement to issue and administer mineral licenses, ease of learning, flexibility of system uses and the ENMCS's ability to easily integrate with other systems. Information system attributes such as ease of use, flexibility, ease of learning and response time affect the users' satisfaction with implemented systems (Petter, Delone and McLean, 2008). The percentage distribution and the mean of the ENMCS attributes construct Likert items are summarized in Table 4.1 below and discussed in the subsequent paragraphs.

Table 4. 1- Percentage distribution and mean of the ENMCS attributes construct

ENMCS Attributes	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
The cadastre system provides accurate and reliable information.	0.00	23.53	30.88	33.82	11.76	3.34
The cadastre system provides up-to-date information.	0.00	48.53	30.88	16.18	4.41	2.76
The cadastre system fulfills all the functional requirements to issue and administer mineral licenses.	0.00	8.82	57.35	29.41	4.41	3.29
It is easy to learn how to use the cadaster system	0.00	25.00	38.24	32.35	4.41	3.16
The cadastre system is flexible in terms of system use (e.g. it is easy to modify the content and format of the system and related outputs)	20.59	5.88	57.35	10.29	5.88	2.75
The cadastre system is flexible enough to be properly modified to meet new business requirements. (eg. When there is an amendment in mining proclamation and regulation the cadastre can be customized to reflect those changes)	2.94	61.76	17.65	17.65	0.00	2.50
The cadastre system can be integrated with systems that are relevant for mineral licensing and administration (eg. With banks to facilitate various modes of payment, with systems that provide spatial information)	0.00	29.41	55.88	14.71	0.00	2.85

(Source: Own survey, 2021)

The aggregate mean, mean of the mean, result for the ENMCS attribute construct is found to be 2.95, which is close to a neutral category rating. The major contributors to an overall neutral category rating of an ENMCS attributes are flexibility related Likert items, flexibility of the system in terms of system use and meeting new business requirements, that have the lowest mean values. This indicates that majority of the respondents disagreed to the flexibility of the ENMCS in issuing and administering mineral rights.

48.53% of respondents disagree with ENMCS's up-to-date information provision. This implies that users are not getting current information to make informed decision and the cause can be related to two things; one is the lack of historical mineral rights data to the updated ENMCS as found out through the semi-structured interview the migration of historical mineral rights data has not been completed so far and the second is inconsistent utilization of the updated ENMCS to issue and administer new mineral rights. More training and efficient knowledge sharing and communication mechanisms needs to be devised to address the 57.35% ENMCS users who are unsure of whether the ENMCS fulfills their current functional requirement and the 38.24% who are neutral on the ease of learning of the ENMCS.

The semi-structured interview that is discussed under section 4.2 revealed that the ENMCS is capable of integrating with other systems such as payment gateways and other systems as required, despite this fact 55.88% of respondents remained neutral on the ENMCS ability to integrate with systems that are relevant to mineral licensing and administration. This indicates that there is a need for efficient communication by the vendor and between regional and federal level ENMCS users on the capabilities of the system to address current needs and future needs.

Therefore, from the ENMCS attributes construct under the technical theme it can be observed that the ENMCS provision of up-to-date information, the flexibility of the ENMCS in terms of use & in terms of meeting future business requirements and the ability of the ENMCS to integrate with other systems are the areas that needs to be addressed to improve user satisfaction and ENMCS post-implementation utilization.

4.1.2.2 ENMCS Post Implementation Utilization Issues: Organizational Theme

The organizational theme consists of top management commitment, training, communication, strategic alignment and user manual. The strategic alignment construct is

addressed through the semi-structured interview and will be discussed under section 4.2. The overall score or the mean of means of organizational related variables has exhibited lower mean result (2.94) than the technical that has an overall mean of 2.95 and operational related variable with a mean of means of 3.46. The issues of ENMCS post-implementation in the context of organizational theme constructs is analyzed and discussed below.

Top Management Commitment

Top management commitment is vital both during system development, implementation and post-implementation stages of an information system to get the functionally required benefits from the system. Top management’s willingness to allow staff to attend the necessary training to efficiently utilize the ENMCS, the discussion with staff on how utilizing the ENMCS impacts their work, the commitment of top management to lead by example through utilizing the ENMCS for approving mineral rights and encouraging the effort of staff member for their effort to learn and use the ENMCS are the Likert items used to assess top management’s commitment. Top management commitment revolves around providing leadership, providing resources and ensuring the smooth running of the whole process to optimize implemented systems utilization (Costa, Ferreira, Bento, Aparicio, 2016; as cited in Fadelelmoula, 2018). The percentage distribution and the mean of the top management commitment construct Likert items are summarized in Table 4.2 below and discussed in the subsequent paragraph.

Table 4. 2 - Percentage distribution and mean of top management commitment construct

Top Management Commitment	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
My immediate supervisor allows me the time to attend cadastre system related training sessions.	16.18	30.88	17.65	27.94	7.35	2.79
My immediate supervisor discusses with me about how the cadastre system impacts my work processes or tasks.	14.71	50.00	5.88	25.00	4.41	2.54

My immediate supervisor checks on the cadastre system before approving the issuance of a new license or renewing an existing license.	2.94	22.06	52.94	20.59	1.47	2.95
My immediate supervisor encourages me to practice on the cadastre system training site and recognizes my effort.	16.18	41.18	20.59	20.59	1.47	2.50

(Source: Own survey, 2021)

When the top management’s commitment is assessed through their willingness and dedication to allow the mineral licensing and administration experts to attend ENMCS related training 30.88 percent of the respondents disagree and 16.18 percent strongly disagree. Half of the respondents (50%) disagree with the statement that the ENMCS impact on their work has been discussed with them and 14.17% of the respondents strongly disagree with the same statement. 52.94 percent of the respondents are unsure whether their supervisor checks on the ENMCS before approving the issuance of a new license or renewing an existing license even though it is mandatory for the supervisor to do so. A significant number of respondents (41.18 %) disagreed with a statement that their supervisor encourages them to practice to optimize their ENMCS utilization and the recognition of their efforts in utilizing the ENMCS. The mean of means for the top management commitment construct is found to be 2.7 which indicates a disagreement on top management’s commitment to improve post-implementation utilization of the ENMCS.

Training

To understand the impact of training on user satisfaction utilizing the ENMCS respondents were asked on the comprehensiveness of the training, the knowledgeableability of the trainers, the change in their level of understanding and their level of confidence in using the ENMCS after attending the training. The percentage distribution and the mean of the training construct Likert items are summarized in Table 4.3 below and discussed in the subsequent paragraphs.

Table 4. 3- Percentage distribution and mean of training construct

Training	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
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The kind of training provided to me was comprehensive enough for me to start using the cadastre system.	0.00	20.59	25.00	52.94	1.47	3.35
My level of understanding about the cadastre substantially improved after going through the cadastre training.	0.00	20.59	22.06	33.82	23.53	3.60
The training gave me confidence to start using the cadastre system	0.00	10.29	26.47	63.24	0.00	3.53
The trainers were knowledgeable and helped me in my understanding of the cadastre system.	0.00	7.35	27.94	61.76	2.94	3.60

(Source: Own survey, 2021)

Despite the fact that 52.94% of the respondents' agreement on the comprehensiveness of the ENMCS training, 63.24 % agreement on the ENMCS's training importance in giving the trainers confidence to start using the system there is still a need for continuous improvement to bring 20.59 % of the respondents who disagreed on the comprehensiveness of the training provided and those who don't believe that there is no substantial improvement in their level of understanding to a level that they can knowledgably utilize the ENMCS to issue and administer mineral rights.

One of a formal organizational support to employees is that providing training and education on new IS as this will reduce stress and anxiety about the use of the system and provides employees with better understanding about the benefits of the system for their task (Lee et al., 2010). Understanding how to train employees effectively to enable them familiarize themselves with the system and develop their computing skill is key to their perception of the usefulness of implemented systems (Rondeau, Ragu-Natha. and Vonderembse, 2010; as cited in Sam-Okomgboeso et al., 2011). Hence it is important for MoMP and regional mineral licensing and administration offices to give due attention for the training of licensing and administration officers on ENMCS utilization.

Communication

Several researchers, including Dezdar and Ainin (2011), Somers et al. (2003) and Lee et al. (2010) stressed the importance of communication across organization to ease the stress of using new system and as a means which leads to improved system acceptance which can improve post-implementation utilization of a system. To assess the efficiency of communication between the production site users of ENMCS Likert items that state the use of email, in person communication and communication through workshops about upgrades and changes on the ENMCS were assessed. The percentage distribution and the mean of the communication construct Likert items are summarized in Table 4.4 below and discussed in the subsequent paragraph.

Table 4. 4- Percentage distribution and mean of communication construct

Communication	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
I was well informed about upgrades, unavailability and changes in the cadastre system through email.	55.88	33.82	4.41	5.88	0.00	1.60
I was well informed about upgrades and changes in the cadastre system through my immediate supervisor or Ministry of mines focal persons.	30.88	60.29	4.41	4.41	0.00	1.80
I was well informed about upgrades and changes in the cadastre system through workshops or presentations.	1.47	63.24	30.88	4.41	0.00	2.38

(Source: Own survey, 2021)

The vast majority of respondents (89.7%) disagreed with a statement that they have been made aware of ENMCS upgrades and unavailability through email. 91 % of the respondents disagreed that their supervisor made them aware of ENMCS upgrades and unavailability. 94 % of the respondents disagreed with a statement that they attend a workshop or a presentation session that aims to inform them of upcoming upgrades or unavailability of the ENMCS. The mean of means for the communication construct is found to be 1.93 which indicates a disagreement on the efficiency of the communication among the production site ENMCS users to improve post-implementation utilization of the ENMCS.

Training Manual

User manuals that are prepared in a way to guide users step by step in completing a certain process or task are useful for users to quickly and effectively perform a task on a system (Keirnan et al, 2002; as cited in Sam-Okomgboeso et al., 2011). The important thing is updating user manuals whenever a new functionality is included or an existing functionality is modified on a system for system users to get up-to-date information from user manuals Scotts (2005) suggested that dynamic information should be included as a link in the master location to ensure that updates get reflected in the user manuals. The Likert items under the user manual construct are aimed to assess the ENMCS’s user manual usefulness, completeness and whether it is being up-to-date. The percentage distribution and the mean of the user manuals construct Likert items are summarized in Table 4.5 below and discussed in the subsequent paragraph.

Table 4. 5 Percentage distribution and mean of communication construct

User Manuals	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
The content and index of the cadastre user manual are useful.	0.00	1.47	51.47	45.59	1.47	3.47
The cadastre user manual is current and up to date.	0.00	0.00	22.06	73.53	4.41	3.80
The cadastre user manual is complete.	0.00	1.47	77.94	20.59	0.00	3.19

(Source: Own survey, 2021)

The majority of respondents (77.94%) agreed with the ENMCS manual being up-to-date. 47% of the respondents agreed with the usefulness of the ENMCS user manual. Even though the mean of means for the user manual construct under the organizational theme is 3.49, which shows an agreement on the user manuals completeness, currency and usefulness there is a need for efficient communication and a continuous improvement on the use of the user manual through updates and training to bring the 77.94 % of respondents who are neutral to a level that they are comfortable to efficiently utilize the ENMCS user manual.

4.1.2.3 ENMCS Post Implementation Utilization Issues: Operational Issues

Two constructs, data quality improvement and internal process improvement, are assessed under the operational themes that affect the post implementation utilization of the ENMCS. The internal process improvement construct is addressed through semi-structured interview and the data quality construct is addressed through the survey. The issues of ENMCS post-implementation in the context of data quality improvement construct is analyzed and discussed below.

Data Quality Improvement

Irrespective of the size and type or system high quality data is critical in determining the system’s ability to produce information for operations, financial reporting and decision making (Xu, 2019). The Likert items under the data quality improvement construct are aimed to assess the appropriateness & completeness of the data output from the ENMCS, whether the ENMCS enables instant capture of incorrect data input, whether using the ENMCS improves data accuracy & integrity and the ENMCS users understanding of the concept and value of integrated data for issuing and administering mineral rights data. The percentage distribution and the mean of the data quality improvement construct Likert items are summarized in Table 4.6 below and discussed in the subsequent paragraph.

Table 4. 6 Percentage distribution and mean of data quality improvement construct.

Data Quality Improvement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
The data output from the cadastre system is appropriate and complete.	0.00	5.88	29.41	47.06	17.65	3.76

Incorrect data input can be instantly discovered by the cadaster system.	0.00	4.41	39.71	42.65	13.24	3.64
The cadastre system users understand the concept and the value of integrated data for issuing and administering mineral rights licenses.	0.00	22.06	52.94	22.06	2.94	3.06
Data accuracy and integrity has been improved by using the cadastre system.	0.00	8.82	47.06	39.71	4.41	3.39

(Source: Own survey, 2021)

The majority of respondents (64.71 %) agreed on the appropriateness and completeness of the data output from ENMCS. 55.89% of the respondents agreed with the fact that ENMCS ability to discover incorrect data input instantly. The mean of means for the data quality improvement construct is 3.46 which shows an overall agreement on the data quality improvement after the ENMCS upgrade. However, 52.94% of the respondents are unsure of whether the production site users understand the value of integrated data in issuing and administering mineral rights and 47.06 % of the respondents are unsure whether the ENMCS upgrade bring an improvement in data accuracy and integrity. The cause of the undecided users can be attributed to the inefficiency of communication as shown in the communication construct of the organizational theme and the challenge to migrate the historical mineral rights information that has been captured in silo at the federal and regional level to the upgraded ENMCS.

As a summary, the paragraphs below summarize the technical, organizational and operational issues that are identified as critical for ENMCS post implementation optimum utilization based on the empirical study:

The finding reveals that communication and top management commitment constructs of the organizational theme with mean values of 1.93 and 2.7 respectively are the issues that should be prioritized for improvement. The mean of means of the ENMCS attributes construct under the technical theme is 2.95, mainly due to the low mean values for Likert items on the ENMCS ability to provide up-to-date information, flexibility and to integrate with other systems. The low mean values for provision of up-to-date information and ability of the ENMCS to be integrated with other systems can be attributed to the inefficient communication, mean value of 1.93, within

federal level licensing and administration experts and between regional and federal experts as the ENMCS is integrated with commercial bank of Ethiopia digital payment channels and up-to-date information is being obtained on licenses issued after the ENMCS upgrade and go live in December 2019. The flexibility aspect of the ENMCS attribute is a critical issue that needs to be addressed for successful ENMCS post implementation utilization.

The training manual construct of the organizational theme even though it has a mean of means of 3.49, could be further improved to make a positive impact on ENMCS post implementation utilization by improving the content and index of the ENMCS manual and assessing its completeness as 77.94% of respondents remain neutral on these aspects of the ENMCS user manual.

The value of integrated data and data accuracy aspects of the data quality improvement construct of the operational theme should be addressed to improve the post implementation utilization of the ENMCS as 52.94% of the respondents remain neutral on these aspects of data quality improvement.

4.1.3 Perceived usefulness of the ENMCS

Perceived usefulness is used to assess the extent of users believes that using a system would enhance job performance (Davis, 1989). Perceived usefulness affects both pre and post implementation of information systems (Bhattacharjee and Premkumar, 2004; as cited in Sam-Okomgboeso et al., 2011). The perceived usefulness of the ENMCS is summarized in table 4.7.

Table 4. 7 Percentage distribution and mean of the perceived usefulness of ENMCS

Percived Usefulness	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean
Using the cadastre system will make my work more efficient (e.g. reducing the time required for performing mineral licensing and administration tasks, making work easier, eliminating overlaps).	1.47	10.29	27.94	51.47	8.82	3.56
Using the cadastre system will increase my job performance.	1.47	10.29	27.94	41.18	19.12	3.66

Using the cadastre system will increase the productivity of my work.	1.47	10.29	29.41	50.00	8.82	3.54
Using the cadastre system will enable me to increase the efficiency of my decision-making (e.g. I can make decisions at a faster pace)	8.82	16.18	20.59	29.41	25.00	3.45

(Source: Own survey, 2021)

The majority of the respondents (60.1%) agreed that using the ENMCS will make them efficient in their work. 60.3% of the respondents agreed that using the ENMCS will increase their job performance and 58.82% of the respondents agreed that using the ENMCS will increase their productivity. 25% of the respondents disagreed that using the cadaster system increases their efficiency in decision making. The mean of means for the perceived usefulness of the ENMCS is 3.55 that can be categorized as agreement and showing that the majority of the users of the ENMCS perceives it as useful despite the lack of top management commitment with regards to users' capacity building and ENMCS usage and inefficient communication at federal and regional level on upgrades, flexibility and ENMCS's ability to integrate with other systems to improve informed decision making. The reasons of the respondents who remain neutral and disagreed with the perceived usefulness of the ENMCS are investigated in relation with the technical, organizational and operational themes. Moreover, the variation in the level of perceived usefulness of the ENMCS and its association with years of experience, position, education level and geographic location of respondents are investigated further.

4.1.4 Level of user satisfaction with ENMCS

User satisfaction remains as an important means of measuring system users' opinions through surveys (DeLone & McLean, 2003). Dezdar and Ainin (2011) stated that information system's features & capabilities and end users' knowledge and understanding of the system are the influencing factors of user satisfaction. The level of users' satisfaction associated with ENMCS utilization is summarized in Table 4.8 below.

Table 4. 8 Frequency and Percentage distribution of users' overall satisfaction with the ENMCS

Overall I am satisfied with the cadastre system		
	Frequency	Percentage

Strongly Disagree	1	1.5
Disagree	8	11.8
Neutral	15	22.1
Agree	29	42.6
Strongly Agree	15	22.1
Total	68	100.0

(Source: Own survey, 2021)

As shown in table 4.8, 64.7% of the respondents are satisfied with the ENMCS. However, 22.1% of the respondents are neither satisfied nor dissatisfied with the ENMCS and 13.3% are dissatisfied with the ENMCS. The reasons for dissatisfied ENMCS users and those who are neither satisfied nor dissatisfied are investigated in relation with the technical, organizational and operational themes. In addition to the relationship and the significance level analysis through Pearson’s correlation and multiple regression the chi-square test is conducted to test whether the actual count and expected count of the five point Likert scale response with the level of overall satisfaction using the ENMCS and its association with years of experience, position, education level and geographic location are significant or not at 0.05 significance level.

4.1.5 Overall Themes Descriptive Analysis (Technical, Organizational and Operational)

The mean and standard deviation of the technical, organizational and operational themes was calculated and shown in Table 4.9 below. Operational theme has the highest mean value of 3.46 with a standard deviation of 0.67, which shows that mineral licensing and administration officers agreed with the operational effectiveness of the ENMCS. The technical theme has the mean value of 2.95 with a standard deviation of 0.7, which shows that mineral licensing and administration officers disagree with ENMCS attributes fulfilling their requirement. Organizational theme has the least mean value of 2.93 with a standard deviation of 0.57, which shows mineral licensing and administration officers disagreement with the organizational effectiveness to promote a successful utilization of ENMCS. Even though respondents are shown to be overall satisfied with the ENMCS and perceive the ENMCS as useful, indicated by the mean values of 3.72 and 3.55 respectively the standard deviations of 0.99 for overall satisfaction and 0.93 for perceived usefulness indicate respondents vary in their assessment.

Table 4. 9 - 10 Descriptive Statistics of ENMCS Post Implementation Critical Success Factors

Theme	Sample Size	Minimum	Maximum	Mean	Std. Deviation
Technical	68	1.85	4.71	2.95	.70
Organizational	68	1.85	4.14	2.93	.57
Operational	68	2.00	5.00	3.46	.67
Perceived Usefulness	68	1.00	5.00	3.55	.93
Overall Satisfaction	68	1.0	5.0	3.72	.99
Valid N (listwise)	68				

(Source: Own survey, 2021)

4.1.6 Reliability of The Survey Instrument

The overall reliability of the survey instrument is high as shown by a high Cronbach's alpha value of 0.953 as shown in table 4.10 below. The high level Cronbach's alpha value indicates that there is a high degree of internal consistency with the items that make up the scale.

Table 4. 10- Overall Reliability Test

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.953	.953	25

(Source: Own survey, 2021)

The reliability of the scales that are prepared to measure the technical, organizational and operational themes are also measured and are all found to be above the 0.7 minimum level reliability indicator proposed by Nunnally (1978). Table 4.11 below shows the Cronbach's Alpha value of each theme.

Table 4. 11- Reliability test of technical, organizational, and operational themes

Theme	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Technical	.915	.917	7
Organizational	.919	.923	14

Operational	.909	.910	4
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(Source: Own survey, 2021)

4.1.7 Validity of The Survey Instrument

The content validity of the survey items is conducted by passing the survey instrument which is adopted from IS post implementation critical success factor related literatures to domain experts from MoMP and the vendors of ENMCS. Furthermore, to assess the convergent validity of the survey items under each theme a factor analysis is conducted to assess the loadings of the Likert items under each construct. The factorability of the data is checked through Bartlett’s test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. “Bartlett’s test of sphericity should be significant at $p < .05$ for the factor analysis to be considered appropriate. The KMO index ranges from 0 to 1, with .6 suggested as the minimum value for a good factor analysis” (Tabachnick & Fidell 2013; as cited in Pallant, 2015). The factor analysis conducted for all the three themes fulfills both the Bartlett’s test of sphericity as the significance level is way less than 0.05 and the KMO greater than 0.7.

Table 4.12 below shows that the items for ENMCS attributes construct under the technical theme strongly loads under component one showing that the items are converging and measuring one construct.

Table 4. 12- Factor loadings of the technical theme

	Component
	1
The cadastre system provides accurate and reliable information.	.881
The cadastre system provides up-to-date information.	.904
The cadastre system fulfills all the functional requirements to issue and administer mineral licenses.	.754
It is easy to learn how to use the cadaster system	.792
The cadastre system is flexible in terms of system use (e.g. it is easy to modify the content and format of the system and related outputs)	.841

The cadastre system is flexible enough to be properly modified to meet new business requirements. (eg. When there is an amendment in mining proclamation and regulation the cadastre can be customized to reflect those changes)	.847
The cadastre system can be integrated with systems that are relevant for mineral licensing and administration (eg. With banks to facilitate various modes of payment, with systems that provide spatial information)	.697

Extraction Method: Principal Component Analysis.

- a. 1 components extracted.
(Source: Own survey, 2021)

Table 4.13 shows that the scale is measuring four constructs under the organizational theme and that component 1 is measuring the training construct as the Likert items for the training are strongly loading with a value greater than 0.72, component 2 is measuring the communication construct, component 3 is measuring top management commitment and component 4 is measuring user manual. Therefor table 4.13 show that there is convergent validity of the items as they clump with strong loadings under the four constructs of the organizational theme.

Table 4. 13- Factor loadings of the Organizational theme

	Component			
	1	2	3	4
My immediate supervisor allows me the time to attend cadastre system related training sessions.			-.730	
My immediate supervisor discusses with me about how the cadastre system impacts my work processes or tasks.			-.884	
My immediate supervisor checks on the cadastre system before approving the issuance of a new license or renewing an existing license.			-.740	
My immediate supervisor encourages me to practice on the cadastre system training site and recognizes my effort.			-.832	
The kind of training provided to me was comprehensive enough for me to start using the cadastre system.	.854			
My level of understanding about the cadastre substantially improved after going through the cadastre training.	.895			

The training gave me confidence to start using the cadastre system	.950		
The trainers were knowledgeable and helped me in my understanding of the cadastre system.	.921		
I was well informed about upgrades, unavailability and changes in the cadastre system through email.		.790	
I was well informed about upgrades and changes in the cadastre system through my immediate supervisor or Ministry of mines focal persons.		.773	
I was well informed about upgrades and changes in the cadastre system through workshops or presentations.		.687	
The content and index of the cadastre user manual are useful.			-.723
The cadastre user manual is complete.			-.888

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

(Source: Own survey, 2021)

Table 4.14 below shows that the items for data quality construct under the operational theme strongly loads under component one showing that the items are converging and measuring one construct.

Table 4. 14- Factor loadings of the Operational theme

	Component
	1
The data output from the cadastre system is appropriate and complete.	.908
Incorrect data input can be instantly discovered by the cadaster system.	.904
The cadastre system users understand the concept and the value of integrated data for issuing and administering mineral rights licenses.	.824
Data accuracy and integrity has been improved by using the cadastre system.	.912

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

(Source: Own survey, 2021)

4.1.8 The relationship between demographic attributes of respondents with the dependent variables

The Chi-square test for independence is a non-parametric test that can be conducted to test the relationship between two categorical variables which have two or more categories (Pallant, 2016). “The Chi-square test for independence compares the observed frequencies or proportions of cases that occur in each of the categories, with the values that would be expected if there was no association between the two variables being measured” (Pallant, 2016). Using the Chi-square test for independence the relationship between years of experience, current job position, education level and geographic location of the survey respondents and their perceived usefulness rating of the ENMCS & their overall satisfaction rating with the ENMCS is analyzed and discussed in subsections 4.1.8.1 and 4.1.8.2 below.

4.1.8.1 The relationship between the demographic attributes of respondents and ENMCS perceived usefulness

Table 4.15 below is the result of the analysis to check the relationship between the respondents’ job position and their perceived usefulness rating of the ENMCS. The null hypothesis of the Chi-square test for independence is that there is no significant relationship between job position and perceived usefulness of ENMCS. As can be seen from the asymptotic significance value for the likelihood ratio value of .289 which is greater than the 0.05 level of significance, therefore the null hypothesis of no significant relationship between job position and ENMCS perceived usefulness can’t be rejected. The analysis implies that the survey data failed to indicate a significant relationship between employee’s current job position and their rating of the ENMCS perceived usefulness.

Table 4. 15 - Chi-Square Test between current position of the respondents and ENMCS perceived usefulness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.670 ^a	12	.260
Likelihood Ratio	14.185	12	.289
N of Valid Cases	68		

(Source: Own survey, 2021)

Table 4.16 below is the result of the analysis to conducted to check the relationship between the respondents’ level of education and their perceived usefulness rating of the ENMCS. As can be seen from the asymptotic significance value for the likelihood ratio the survey data failed to indicate a significant relationship between employee’s level of education and their rating of the ENMCS perceived usefulness.

Table 4. 16- Chi-Square Test between respondents’ level of education and ENMCS perceived usefulness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.412 ^a	4	.353
Likelihood Ratio	5.794	4	.215
N of Valid Cases	68		

(Source: Own survey, 2021)

Table 4.17 below is the result of the analysis conducted to check the relationship between the respondents’ work experience and their perceived usefulness rating of the ENMCS. As can be seen from the asymptotic significance value for the likelihood ratio the survey data failed to indicate a significant relationship between work experience and ENMCS perceived usefulness.

Table 4. 17 - Chi-Square Test between respondents’ work experience and ENMCS perceived usefulness.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	20.301 ^a	24	.680
Likelihood Ratio	20.411	24	.673
N of Valid Cases	68		

(Source: Own survey, 2021)

The analysis also revealed that there is no association between the respondents from regional and federal mineral licensing and administration offices and their rating of perceived

usefulness of the ENMCS as seen by the Asymptotic significance level for the likelihood ratio with a value of 0.141 which is greater than the 0.05 level of significance as shown in table 4.18 below.

Table 4. 18- Chi-Square Test between respondent’s geographic location and ENMCS perceived usefulness.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.418 ^a	4	.170
Likelihood Ratio	6.904	4	.141
N of Valid Cases	68		

(Source: Own survey, 2021)

4.1.8.2 The relationship between the demographic attributes of respondents and their overall satisfaction with the ENMCS

The Chi-square test for independence analysis has shown that there is no significant relationship between respondents’ years of experience, current job position, education level and geographic location and their rating of overall satisfaction with the ENMCS as shown by the likelihood ratio asymptotic significance level in tables 4.19,4.20,4.21 and 4.22 below.

Table 4. 19 - Chi-Square Test between current job position and overall satisfaction with ENMCS

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.259 ^a	12	.507
Likelihood Ratio	9.029	12	.700
N of Valid Cases	68		

(Source: Own survey, 2021)

Table 4. 20 - Chi-Square Test between level of education and overall satisfaction with ENMCS

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.361 ^a	4	.359
Likelihood Ratio	5.994	4	.200
N of Valid Cases	68		

(Source: Own survey, 2021)

Table 4. 21- Chi-Square Test between work experience and overall satisfaction with ENMCS

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	21.085 ^a	24	.634
Likelihood Ratio	21.769	24	.593
N of Valid Cases	68		

(Source: Own survey, 2021)

Table 4. 22 - Chi-Square Test between geographic location and overall satisfaction with ENMCS

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.956 ^a	4	.138
Likelihood Ratio	7.843	4	.098
N of Valid Cases	68		

(Source: Own survey, 2021)

4.1.9 Overall Themes Inferential Analysis (Technical, Organizational and Operational)

To assess the relationship between the constructs under the three themes with the dependent variables of the study which are perceived usefulness and overall satisfaction. Correlation, Multiple regression and independent sample t-test are conducted to test the relationship and accept or reject the proposed study hypotheses. The findings of these test are discussed under subsections 4.1.9.1 to 4.1.9.4.

4.1.9.1 Correlation

To test the relationship between the ENMCS attributes construct (technical theme), top management commitment, training, communication and training manual constructs (organizational theme) and data quality construct (Operational theme) with perceived usefulness and overall satisfaction a Pearson’s correlation analysis is conducted. The result of the analysis has shown significant relationship between the constructs and with the dependent variables of perceived usefulness and overall satisfaction as shown in tables 4.23 and 4.24 below.

Table 4. 23 - Pearson correlation result for technical, organizational, operational themes and perceived usefulness of the ENMCS

	ENMCS Attributes	Top Management Commitment	Training	Communication	Training Manual	Data Quality Improvement	Perceived Usefulness
Technical Theme	1	.803**	.483**	.465**	.463**	.524**	.482**
Sig. (2-tailed)		.000	.000	.000	.000	.000	.000

	N	68	68	68	68	68	68	68
Top Management Commitment		.803**	1	.641**	.459**	.517**	.682**	.587**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000
	N	68	68	68	68	68	68	68
Training		.483**	.641**	1	.432**	.602**	.646**	.816**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	68	68	68	68	68	68	68
Communication		.465**	.459**	.432**	1	.470**	.418**	.451**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	68	68	68	68	68	68	68
Training Manual		.463**	.517**	.602**	.470**	1	.558**	.632**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
	N	68	68	68	68	68	68	68
Data Quality Improvement		.524**	.682**	.646**	.418**	.558**	1	.674**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	68	68	68	68	68	68	68
Perceived Usefulness		.482**	.587**	.816**	.451**	.632**	.674**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	
	N	68	68	68	68	68	68	68

** Correlation is significant at the 0.01 level (2-tailed).
(Source: Own survey, 2021)

Table 4. 24 - Pearson correlation result for technical, organizational, operational themes and Overall Satisfaction

	Technical Theme	Top Management Commitment	Training	Communication	Training Manual	Data Quality Improvement	Overall Satisfaction
Technical	1	.803**	.483**	.465**	.463**	.524**	.464**

Theme	Sig. (2-tailed)								
	N	68	68	68	68	68	68	68	68
Top Management Commitment	Sig. (2-tailed)	.803**	1	.641**	.459**	.517**	.682**	.576**	
	N	68	68	68	68	68	68	68	68
Training	Sig. (2-tailed)	.483**	.641**	1	.432**	.602**	.646**	.787**	
	N	68	68	68	68	68	68	68	68
Communication	Sig. (2-tailed)	.465**	.459**	.432**	1	.470**	.418**	.411**	
	N	68	68	68	68	68	68	68	68
Training Manual	Sig. (2-tailed)	.463**	.517**	.602**	.470**	1	.558**	.618**	
	N	68	68	68	68	68	68	68	68
Data Quality Improvement	Sig. (2-tailed)	.524**	.682**	.646**	.418**	.558**	1	.666**	
	N	68	68	68	68	68	68	68	68
Overall Satisfaction	Sig. (2-tailed)	.464**	.576**	.787**	.411**	.618**	.666**	1	
	N	68	68	68	68	68	68	68	68

** Correlation is significant at the 0.01 level (2-tailed).
(Source: Own survey, 2021)

4.1.9.2 Multiple Linear Regression for Hypothesis Testing

To test the proposed hypotheses and answer the research questions on the significant relationship between the technical, organizational and operational issues with the perceived usefulness of ENMCS and overall satisfaction a multiple linear regression analysis is conducted.

The multiple linear regression analysis conducted using overall satisfaction as dependent variable showed that 68% of the variation in overall satisfaction with ENMCS is explained by the independent variables of ENMCS attributes, top management commitment, training, communication, training manual and data quality improvement as shown in Table 4.25 below by an $R^2 = 0.679$, which is statistically different from zero and overall the model is statistically significant as shown by an Anova table's p-value that is less than 0.001 in Table 4.26. The coefficients table, Table 4.27, has shown that only training and data quality improvement have a statistically significant relationship with overall satisfaction at a p-value less than 0.05.

Table 4. 25 - Model Summary for overall satisfaction as dependent variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.824 ^a	.679	.648	.5879

a. Predictors: (Constant), Data Quality Improvement, Communication, Technical Theme, Training Manual, Training , Top Management Commitment
(Source: Own survey, 2021)

Table 4. 26 Anova for overall satisfaction as dependent variable

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44.611	6	7.435	21.515	.000 ^b
	Residual	21.081	61	.346		
	Total	65.691	67			

a. Dependent Variable: Overall Satisfaction
b. Predictors: (Constant), Data Quality Improvement, Communication, Technical Theme, Training Manual, Training , Top Management Commitment
(Source: Own survey, 2021)

Table 4. 27 Coefficients of predictor variables for overall satisfaction as dependent variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound

1	(Constant)	-1.398	.659		-2.120	.038	-2.716	-.079
	Technical Theme	.066	.176	.047	.376	.708	-.286	.419
	Top Management Commitment	-.064	.154	-.061	-.414	.681	-.371	.244
	Training	.725	.143	.553	5.075	.000	.439	1.010
	Communication	.007	.156	.004	.045	.965	-.305	.319
	Training Manual	.383	.231	.163	1.659	.102	-.079	.845
	Data Quality Improvement	.342	.161	.234	2.131	.037	.021	.663

a. Dependent Variable: Overall Satisfaction
(Source: Own survey, 2021)

The multiple linear regression analysis conducted using perceived usefulness as dependent variable showed that 72% of the variation about respondents' perceived usefulness of ENMCS is explained by the independent variables of ENMCS attributes, top management commitment, training, communication, training manual and data quality improvement as shown in Table 4.28 below by an $R^2 = 0.723$, which is statistically different from zero and overall the model is statistically significant as shown by an Anova table's p-value that is less than 0.001 in Table 4.29. The coefficients table, Table 4.30, has shown again that only training and data quality improvement have a statistically significant relationship with perceived usefulness at a p-value less than 0.05.

Table 4. 28 Model Summary for perceived usefulness as dependent variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.850 ^a	.723	.696	.51595

a. Predictors: (Constant), Data Quality Improvement, Communication, Technical Theme, Training Manual, Training , Top Management Commitment
(Source: Own survey, 2021)

Table 4. 29 - Anova for perceived usefulness as dependent variable

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	42.367	6	7.061	26.525	.000 ^b
Residual	16.239	61	.266		

Total	58.606	67			
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a. Dependent Variable: Perceived Usefulness

b. Predictors: (Constant), Data Quality Improvement, Communication, Technical Theme, Training

Manual, Training , Top Management Commitment

(Source: Own survey, 2021)

Table 4. 30 - Coefficients of predictor variables for perceived usefulness as dependent variable

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-1.402	.579		-2.424	.018	-2.559	-.245
	Technical Theme	.086	.155	.065	.558	.579	-.223	.396
	Top Management Commitment	-.090	.135	-.092	-.670	.505	-.360	.179
	Training	.734	.125	.593	5.861	.000	.484	.985
	Communication	.076	.137	.045	.558	.579	-.197	.350
	Training Manual	.335	.203	.151	1.654	.103	-.070	.741
	Data Quality Improvement	.300	.141	.217	2.129	.037	.018	.582

a. Dependent Variable: Perceived Usefulness

Top management commitment, ENMCS attributes, training, communication, training manual and data quality improvement constructs all showed a significant positive correlation with both ENMCS perceived usefulness and overall satisfaction as shown in table 4.23 and table 4.24 respectively. IT is also found that when simple regression analysis is conducted all the constructs are found to have a significant positive relationship with perceived usefulness and overall satisfaction as proposed in this study moreover the interview findings discussed in section 4.2 below further strengthened the impact of the constructs on overall user satisfaction.

However, based on the level of significance shown in table 4.30, the multiple linear regression using all the constructs as predictor variables only training construct and data quality improvement construct showed significant positive relationship with perceived usefulness and overall satisfaction. This model should be retested with a higher population size for other IS post implementation study or a repeated test in a year time after zonal and woreda level mineral licensing experts become ENMCS users. Moreover, mediating variables that affect top

management commitment, communication, ENMCS attributes and training manual constructs needs to be assessed through literature review and by conducting more exploratory interviews with regional and federal level ENMCS users to assess whether or not their significant positive relationship as found in IS post implementation evaluation literatures can be found through mediating variables that are domain and country context dependent. Table 4.31 below shows the accepted and rejected hypotheses of the study.

Table 4. 31 Accepted and rejected hypotheses of the study

H1: There is a significant direct relationship between ENMCS attributes and overall user satisfaction.	Rejected
H2: There is a significant direct relationship between ENMCS attributes and ENMCS's perceived usefulness.	Rejected
H3: There is a significant direct relationship between top management commitment and overall user satisfaction.	Rejected
H4: There is a significant direct relationship between top management commitment and ENMCS's perceived usefulness.	Rejected
H5: There is a significant direct relationship between training and overall user satisfaction.	Accepted
H6: There is a significant direct relationship between training and ENMCS's perceived usefulness.	Accepted
H7: There is a significant direct relationship between communication and overall user satisfaction.	Rejected
H8: There is a significant direct relationship between communication and ENMCS's perceived usefulness.	Rejected
H9: There is a significant direct relationship between user manual and overall user satisfaction.	Rejected
H10: There is a significant direct relationship between user manual and ENMCS's perceived usefulness.	Rejected
H11: There is a significant direct relationship between data quality improvement and overall user satisfaction.	Accepted
H12: There is a significant direct relationship between data quality improvement and ENMCS's perceived usefulness.	Accepted

(Source: Own survey, 2021)

4.1.9.3 Independent Sample t-test

To answer the research question on whether there exists a significant relationship between mineral licensing officers' duty station, those who work at federal level and those who work at the regions, with their overall satisfaction using the ENMCS and their perceived usefulness

rating of the ENMCS an Independent Sample t-test is conducted. An Independent sample t-test tests whether the difference between the mean overall satisfaction value and the mean perceived usefulness value of federal and regional ENMCS users is statistically different from zero. The null hypothesis of an Independent sample t-test states that the difference between the mean overall satisfaction and ENMCS perceived usefulness of the federal and regional ENMCS users is zero (there is no statistically significant mean value difference with their overall satisfaction and ENMCS perceived usefulness rating). Table 4.32 and table 4.33 below shows that the mean overall satisfaction and the mean perceived usefulness rating of federal ENMCS users are slightly higher than that of the regional ENMCS users respectively. And table 4.34 and table 4.35 shows that the mean difference in overall satisfaction and perceived usefulness is statistically different from zero as shown by the p-value of 0.009 and 0.015 respectively.

Table 4. 32-Overall Satisfaction mean value between federal and regional ENMCS users

	Directorate/Section/Region	N	Mean	Std. Deviation	Std. Error Mean
Overall	MoMP	30	4.067	.7849	.1433
Satisfaction	Regions	38	3.447	1.0577	.1716

(Source: Own survey, 2021)

Table 4. 33- Overall Satisfaction mean difference significantly difference from zero

		Levene's Test for Equality of Variances					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Overall Satisfaction	Equal variances assumed	6.550	.013	2.676	66	.009	.6193
	Equal variances not assumed			2.770	65.783	.007	.6193

(Source: Own survey, 2021)

Table 4. 34 - Perceived Usefulness mean value between federal and regional ENMCS users

	Directorate/Section/Region	N	Mean	Std. Deviation	Std. Error Mean
Perceived Usefulness	MoMP	30	3.8583	.85269	.15568
	Regions	38	3.3158	.93845	.15224

(Source: Own survey, 2021)

Table 4. 35 - Perceived usefulness mean difference

		Levene's Test for Equality of Variances					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Perceived Usefulness	Equal variances assumed	.926	.339	2.463	66	.016	.54254
	Equal variances not assumed			2.492	64.648	.015	.54254

(Source: Own survey, 2021)

4.1.9.4 Research Model Fitness (Taking the mean of means for all the three themes)

When the mean of means of the constructs under each theme calculated and a multiple linear regression conducted it was found that the organizational them and the operational theme has a significant positive relationship with ENMCS perceived usefulness and Overall satisfaction. The multiple linear regression analysis conducted using overall satisfaction as dependent variable showed that 60% of the variation in overall satisfaction with ENMCS is explained by the independent variables of technical theme, organizational theme and operational theme as shown in Table 4.36 below by an $R^2 = 0.601$, which is statistically different from zero and overall the model is statistically significant as shown by an Anova table's p-value that is less than 0.001 in table 4.37. The coefficients table, table 4.38, has shown that organizational and

operational themes have a statistically significant relationship with overall satisfaction at a p-value less than 0.001 and p-value of 0.042 respectively.

Table 4. 36 - Model Summary for overall satisfaction as dependent variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.775 ^a	.601	.582	.6399

a. Predictors: (Constant), Operational Theme, Technical Theme, Organizational Theme
(Source: Own survey, 2021)

Table 4. 37 - Anova for overall satisfaction as dependent variable

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	39.486	3	13.162	32.144	.000 ^b
	Residual	26.206	64	.409		
	Total	65.691	67			

a. Dependent Variable: Overall Satisfaction
b. Predictors: (Constant), Operational Theme, Technical Theme, Organizational Theme
(Source: Own survey, 2021)

Table 4. 38 - Coefficients of predictor variables for overall satisfaction as dependent variable

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.209	.436		-.479	.633
	Technical Theme	-.243	.164	-.172	-1.483	.143
	Organizational Theme	1.179	.250	.695	4.723	.000
	Operational Theme	.356	.172	.243	2.070	.042

(Source: Own survey, 2021)

The multiple linear regression analysis conducted using perceived usefulness as dependent variable showed that 64 % of the variation ENMCS's perceived usefulness is explained by the independent variables of technical theme, organizational theme and operational theme as shown in table 4.39 below by an $R^2 = 0.638$, which is statistically different from zero and overall the model is statistically significant as shown by an Anova table's p-value that is less than 0.001 in

table 4.40. The coefficients table, table 4.41, has shown that organizational and operational themes have a statistically significant relationship with ENMCS perceived usefulness at a p-value less than 0.001 and p-value of 0.057 respectively.

Table 4. 39 Model Summary for perceived usefulness as dependent variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.799 ^a	.638	.621	.57599

a. Predictors: (Constant), Operational Theme, Technical Theme, Organizational Theme
(Source: Own survey, 2021)

Table 4. 40 - Anova for perceived usefulness as dependent variable

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.373	3	12.458	37.549	.000 ^b
	Residual	21.233	64	.332		
	Total	58.606	67			

a. Dependent Variable: Percived Usefulness
b. Predictors: (Constant), Operational Theme, Technical Theme, Organizational Theme
(Source: Own survey, 2021)

Table 4. 41 - Coefficients of predictor variables for perceived usefulness as dependent variable

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.243	.393		-.618	.538
	Technical Theme	-.238	.147	-.179	-1.614	.111
	Organizational Theme	1.195	.225	.746	5.320	.000
	Operational Theme	.300	.155	.217	1.937	.057

(Source: Own survey, 2021)

As shown by the multiple regression output of the significant positive relationship between the organizational and operational themes, the organizational theme constructs should be prioritized for improvement followed by the data quality improvement construct of the operational theme both at federal and regional level to optimize the post implementation utilization of the ENMCS.

4.2 Qualitative Data Analysis

To triangulate and supplement the quantitative data analysis findings of the study, semi-structured interviews are conducted with two federal and three regional mineral licensing and administration directors. Twenty interview questions that are categorized to address the ENMCS attributes, ENMCS's strategic alignment with the strategic direction of Ethiopia for the mining sector, user support, vendor support, top management commitment, training, communication, internal process improvement and data quality improvement constructs of the technical, organizational and operational themes that affect perceived usefulness of the ENMCS and Overall satisfaction of users. Accordingly, the main themes of the interview output for the constructs are analyzed and discussed below.

The interviewees were requested whether the upgraded ENMCS fulfills their current functional requirement and have all the attributes to enable them issue and administer mineral rights. Four of the interviewees said that the current functionalities which are designed based on the Ethiopian mining proclamation and regulation and also on the federal and regional level business process to issue and administer mineral rights fulfills the requirement. One interviewee replied that "There was a live-chat option to have a live interaction with new applicants and existing mineral license holders that an established working group from MoMP saw during a benchmarking visit in Kenya, however that functionality is not included for the Ethiopian Mining Cadastre after the working group from the MoMP, that was responsible to work with the vendors during the ENMCS upgrade, told the vendors not to include that functionality since MoMP does not have a dedicated help desk in MoMP's organizational structure to attend to the live customer requests".

On other ENMCS attributes related questions the interviewees were asked whether the ENMCS is designed in a way to accommodate future changes that will arise due to a change either in mining proclamation, regulation or business process and on the ENMCS's ability to integrate with other systems. The response of the federal mineral licensing and administration directors differs from the regional directors. The federal mineral licensing and administration directors stated that the ENMCS vendors explained to them that changes like maximum area size for application, change in rate of land rent for annual fee calculation, change in the rate of mining royalty calculation, a change in scheduling annual work program, a change in scheduling

annual report and amending and modifying mineral commodity groups can be changed by an ENMCS user with an administrative privilege. Moreover, the federal mineral licensing and administration directors also confirm the ENMCS's ability to integrate with other system by giving examples of the ENMCS integration with Commercial Bank of Ethiopia electronic payment channels and Geological Survey of Ethiopia's integrated geoscience information management system.

The three regional directors however are unaware of the system's ability to integrate with other systems as required and the possibility of accommodating changes that may arise due to changes in the mining proclamation, regulation or business process change. This finding is supported also by the survey finding as 64% of respondents disagreed with the flexibility of the system to accommodate future changes and 56% of respondents remain neutral on the ENMCS's ability to integrate with other systems. The inefficient communication between federal level directors, regional level directors and mineral licensing and administration officers both at the federal and regional level as found also from the survey by the lowest mean of mean value of 1.93, which shows disagreement on being communicated with issues related to the ENMCS, is the gap that created unawareness on the ENMCS flexibility and the ability to integrate with other systems.

Information quality as measured by system out-put in the form of reports and on screen displays and system quality with characteristics of ease of use, flexibility, sophistication, reliability and response time as measures of IS performance from technical and design perspective are found to have a significant positive relationship with user satisfaction (Noor'Aini Ismail et al, 2014). Attributes like ease of use is found to affect the satisfaction of users and perceived usefulness of systems as found by IS post implementation researchers (Issa Al Zoubi, 2018; as cited in Kouki, 2009). Effective communication and training on ENMCS's flexibility, ease of use and ability to integrate with other systems which will increase the level of sophistication need to be addressed by MoMP and regions.

The interviewees were asked whether the ENMCS is strategically aligned with the business need for the mining sector of Ethiopia and if aligned how that can be explained and if not what they recommend. All the interviewees replied that the ENMCS is aligned with the business need for the mining sector and that it can be explained by the transparency the ENMCS

brought by showing the information on mineral license holders and applicants to investors and the public through the e-government portal. In addition to the transparency the efficiency of performing the tasks of issuing and administering mineral rights becomes as it is conducted online. As one interviewee puts it “The upgraded ENMCS with the e-government portal reduces the licensing office’s work load as the license holders or new applicants do much of the work that used to be conducted by the licensing officer; such as checking available spaces for application, relinquishing an area as per the requirement on the law and applying for duty free privilege online and they can check the status of each online”.

Many literatures recognize that the main cause of failing to benefit from realized system’s potential is the alignment gap between IT systems and business strategies (Preseley, 2006, Rathman et al., 2005; as cited by Kouki, 2009). The ENMCS’s alignment with the business strategies for the mining sector Ethiopia is therefore crucial.

The interviewees were asked the ENMCS vendor’s responsiveness to address issues after the go-live and the quality of the user support they received from the ICT departments at the regional and federal level. The federal mineral licensing and administration directors stated that the vendors are responsive and issues are mostly resolved immediately. The regional directors however said that they don’t have direct communication with the vendors and their requests are addressed through federal licensing and administration directors, who are designated contact persons with the vendor to address ENMCS issues faced by the users both at federal and regional level.

All the interviewed directors stated that they are not getting the support they require from the ICT department as the ICT department experts did not involve during the upgrading of the ENMCS and neither did they take the training on the system’s functionalities. The ICT support that users get both at the federal and regional level are related with the maintenance and installation of network cables, WIFI hotspots and troubleshooting desktop and printer malfunctions.

When strategic alignment is assessed it is not only answering the question of whether the system supports a firm’s business strategy but should also include the IT support to the business processes, the IT function status in the company and involvement in business strategy formulation and the management practices the impact alignment (Tallon, 2008, Rathman, et al.,

2005; as cited by Kouki, 2009). As found from the interview MoMP's IT currently is not in a position to support the ENMCS post implementation system utilization related challenges as the IT department was not part of the business strategy formulation and also did not work closely with the vendors to gain the required knowledge to provide support when needed.

On the interview question regarding the top management's commitment to support federal and regional mineral licensing and administration bodies to efficiently utilize the upgraded ENMCS, the interviewees raised four key areas that should be addressed by top management for sustainable and efficient utilization of the ENMCS; training, enabling ICT infrastructure, enabling organizational structure and performance based recognition and reward. Top management commitment is a construct in the survey with the second lowest mean of means value of 2.7 which shows respondents disagreement in top management's commitment to create enabling conditions for sustainable utilization of the ENMCS.

The training is the priority area that the regional interviewees raised. As one regional interviewee puts it "I only get a five days' classroom structured training in Addis Ababa more than a year and half ago and I can only send one licensing and administration officer to the training out of the three that are working on issuing and administering mineral rights as they have to attend to customers, even though I and the other licensing officer who attend the training tried to impart the knowledge we obtained, we still have to call the federal level directors who are the trainers on the system when we ran into trouble." All three regional interviewees stated that their staff are not well trained to efficiently utilize the ENMCS. One regional interviewee suggested for MoMP to train more trainers of trainees who can frequently travel to the regions to conduct on-job training and also cover licensing officers who resign from their position often with a short notice period.

The federal licensing directors also acknowledge the inadequacy of the training provided to the regions and mentioned that they have constraints in terms of trained people working on the ENMCS as senior staff who have years of experience working on both the previous flexi cadaster and the upgrade ENMCS transferred to another directorate.

The realization of highly complex integrated systems creates a critical need to train the anticipated users on the different skills and functions of the system (Fadellelmoula, 2018). A study conducted on the effect of organizational support on ERP implementation by Lee et al.,

(2010) a significant positive relationship is found between training and perceived usefulness. Similar result of significant positive relationship between training construct of the organizational theme and user satisfaction and perceived usefulness is also found by this study, indicating the importance of training to improve ENMCS post implementation utilization.

All the directors from the regions stated that they lack the enabling ICT infrastructure like dedicated and reliable internet connections, shortage of desktop computers as licensing officers are forced to share a single desktop computer to work on by taking turns and accessories like printers and power backup batteries to consistently use the ENMCS and these things are not budgeted for by the regions and needs top management commitment to support the regional mining offices with enabling ICT infrastructure. As one regional interviewee commented on the unreliable internet connection “We often have to wait until lunch time or after the end of working hours for the office internet to allow us to open the cadastre site since during working hours the 2mb internet connection is shared by more than 50 people, who are working in various departments of the water, mineral and energy bureau, and sometimes watch social media sites with streaming videos which makes it difficult for us to conduct the mineral licensing operations”. Unlike the regional directors the federal level directors are more equipped as far as ICT infrastructure is concerned.

Kouki (2009) stressed the importance of financial support to cover post implementation stage costs such as IT infrastructure improvement, training and system upgrades through top management commitment. “It has been also argued that the top management perceptions and attitude towards the system could shape the norms and values of the organization to facilitate (or impede) the system assimilation” (Chatterjee et al., 2002; as cited by Kouki, 2009). There is a need to address the top management commitment especially with regards to improving regional IT infrastructure and allocating the budget for training.

With regards to enabling organizational structure both federal and regional directors stressed the need for a dedicated support team, either as part of ICT directorate or as a separate new directorate in MoMP’s organizational structure, to specifically address ENMCS related issues. One regional interviewee said that “when we email issues with the ENMCS it could be days before we get a reply from the federal directors and when we give them a call they are usually busy with their day to day work managing the mineral licensing and administration

process, if a dedicated team is established at the federal level to provide real time support to the regions when requested it will improve the system's utilization at the regional level".

It is when users start working with new systems and learning about its limit that problem reporting, adjustment and additional functional requirement become flooding during post implementation stage (Musaji, 2005; as cited by Kouki, 2009). The seemingly endless request from users of newly implemented systems requires an internal IT expertise to provide system maintenance and the support requested by users (Musaji, 2005; as cited by Kouki, 2009). MoMP IT expertise need to work with the ENMCS vendors so that the required knowledge to sustainability support federal and regional level users beyond the end of the vendor support period.

Another area that both regional and federal interviewees indicate as a lack of top management commitment is that recognition and reward for mineral licensing and administration officers who took self-initiative to practice and improve their skill after the training on efficiently utilizing the ENMCS. As one regional interviewee said "we lose competent licensing officers who are efficient in utilizing the ENMCS for both private sector and other departments like water works and environmental protection in the same bureau sometimes to a small difference in monthly salary".

"Rewarding the acquisition of new skills, linking compensation to company profits and other strategies promote learning and the institutionalization of favorable behaviors" (Jerez-Gómez et al., 2005; as cited by Kouki, 2009). Contingent rewards and praise are found to foster learning, risk taking, innovation, collaboration and collegial support for IS post implementation success (Kei & Wei, 2008). MoMP and regional mining bureaus need to come up with a reward and recognition programs to promote ENMCS post implementation utilization through learning, collaboration and collegial support.

The interviewees were asked about their view on the structure of the training, the competency of the trainers and on the completeness and ease of use of the training manual in enabling users to efficiently utilize the ENMCS. All the interviews stated that the trainers are competent which is in line with the survey finding in which the majority of the respondents, 65%, agreed on the trainers being knowledgeable and competent. The regional interviewees stated that the one-time classroom structured training is not sufficient and should have been

followed up with periodic on-job training at regional mines bureaus. The interviewed federal licensing and administration directors acknowledged the insufficiency of the classroom structured training and that it was originally planned to conduct on-job trainings at the regions but due to unavailability of budget, being short on licensing officers to do the day to day operational activities that hinders them to send trainers of trainees to the regions and the challenge of the pandemic caused by COVID-19 to conduct in person training.

Both federal and regional level interviewees stated that there is a need to improve the user manual that is provided by the vendor as it is not structured in a way that assists users to conduct specific tasks and it lacks examples that users can use to practice by themselves. One regional interviewee said that “It would have been good if the vendor structured the training manual to get specific activity conducted by following a step by step approach providing example data sets on ENMCS training site and then assess the users competency level through an online quiz on the training site that can generate competency certificate to motivate users to self-improve themselves on the training site rather than just checking what is being displayed when they click buttons on the ENMCS site”

The realization of highly complex integrated systems creates a critical need to train the anticipated users on the different skills and functions of the system (Fadellelmoula, 2018). Researches also indicate that task oriented user manuals with documented step by step guide enable users in quickly and effectively perform a task (Keirnan et al, 2002; as cited in Sam-Okomgboeso et al., 2011). A study conducted on the effect of organizational support on ERP implementation by Lee et al., (2010) had found a significant positive relationship between training and perceived usefulness. Similar result of significant positive relationship between training construct of the organizational theme and user satisfaction and perceived usefulness is also found by this study, indicating the importance of training to improve ENMCS post implementation utilization.

The interviewees asked about how they are being communicated about ENMCS issues such as upgrades, bug fixes, offline periods during version updates etc. and how efficient were those communications. All three regional interviewees stated that they are made aware of important ENMCS issues such as upgrades, additional functionalities and temporary system unavailability after the activities already happened and feel that their role and input in these

process are not valued at the federal level. The two interviewees from federal mineral licensing and administration stated that they pass information that came from the ENMCS vendor as they are the focal points for communication using the email contact address in the ENMCS log file, which they said is not complete as some regional and federal level ENMCS users did not provide their email address.

Communication across an organization is critical successful IS implementation and post implementation changes (Dezdar and Ainin, 2011). Effective communication helps in minimizing user resistance and is important for system acceptance (Somers and Nelson, 2004). MoMP and regions needs to address the communication issue as it has an overarching effect on all the constructs under technical, organizational and operational issues that affect ENMCS post implementation utilization.

The interviewees were also asked whether the ENMCS improved their internal processes and the completeness, accuracy and reliability of the information obtained from the public facing e-government portal. The federal level interviewees stated that despite the ability of the ENMCS to allow users from directorates such as environment and finance the users have not been incorporated in the system to conduct their part in the mineral licensing and administration process. Both regional and federal interviewees confirmed that accurate and reliable information is obtained for the licenses issued after the ENMCS upgrade as the applicants are mandatorily required to start the application process online through the portal and the production site users process their application until granting on the portal, however they admit the challenge of migrating the licenses that are issued prior to the ENMCS upgrade. A federal level interviewee said that “Even though the number varies all regions and MoMP have licenses that are yet to be updated on the ENMCS site as due to various reasons but the major reason is finding their payment receipts to close past payment actions so that the system schedules their next payment obligation and locating the hardcopy receipts, scanning and uploading them to the system requires additional human resource or establishing a task force to complete it in a short time but we currently don’t have that”.

Failure in providing high data quality to the organization have brought various issues such as false decision due to incorrect data, high cost of operation and lack of customer satisfaction. “In data quality assessment and improvement process, participation of data users

and other data stakeholders that are involve during data entry, data processing and data analysis is important” (Jaya et al., 2017). A participatory data quality assessment needs to be conducted at federal and regional level to migrate mineral licenses information, for licenses that have been issued prior to the ENMCS upgrade.

The interview findings were complimentary to the survey findings and explain why the organizational issues especially top management commitment and communication constructs have lower mean of means, which indicate disagreement of respondents on top management’s commitment in creating enabling conditions that improves ENMCS post implementation utilization and the inefficient communication that create information gap for both federal and regional level ENMCS users. Even though the multiple linear regression analysis finding of a significant positive relationship with both perceived usefulness and overall satisfaction, which is also supported by the interviewee it is practically impossible to support training and continuous improvement without financial and non-financial resources made available through top management commitment. As shown by the semi-structured interview top management commitment have an overarching effect on all the constructs under the technical, organizational and operational themes. Despite the challenges discussed by the interviewees they all say that they are optimistic that the ENMCS utilization will improve if the enabling ICT infrastructure is put in place and reasonable training budget is allocated through top management commitment.

Chapter Five

Findings of the study and proposed high level ENMCS post implementation utilization improvement organizational guide

5.1 Findings of the Study

The study findings revealed that the most important issues to address first to improve the post implementation utilization of the ENMCS are the organizational issues followed by operational issues. Among organizational issues, the training construct are found to be the most critical that affects the perception of ENMCS users on the usefulness of the system and their overall satisfaction as indicated by the significant positive relationship between training and both ENMCS perceived usefulness and overall satisfaction. The interview also revealed that no continuous follow-up training to capacitate ENMCS users to improve the utilization of the system has been conducted. Even though a positive significant relationship between training manual and both perceived usefulness and overall satisfaction is not found by the multiple linear regression the qualitative analysis and the interview revealed that the training manual needs to be structured in a way to enable users to accomplish specific tasks on the ENMCS. Moreover, the Pearson correlation coefficient showed a significant positive correlation between training manual and both overall user satisfaction and perceived usefulness of the ENMCS.

The data quality improvement construct of the operational issue is another area that needs improvement as it has a significant positive relationship with both perceived usefulness and overall satisfaction. The qualitative analysis of the survey data indicated that ENMCS users are uncertain about the improvement on data accuracy and integrity that is brought about by the upgrade of the ENMCS as 47% of the respondents remain neutral. The interview findings on the data accuracy and integrity showed that mineral rights information that was captured as silo at the regional and federal level have not been cleaned and updated on the upgraded ENMCS that affects the accuracy and integrity of the data which in turn will affect both internal user

satisfaction as it reduces their efficiency of issuing and administering mineral rights and also the satisfaction of investors who are using the e-government portal to apply for new licenses and administer their existing licenses.

Post-implementation training and education allows users to comfortably use an implemented system by updating their knowledge, improving their understanding of the system's implications for the organization's processes and the impact of their action on various business processes (Jasperson et al., 2005, Nicolaou, 2004; as cited in Kouki et al., 2009). The significant positive relationship of training with perceived usefulness is consistent with the study findings of Sam-Okomgboeso et al. (2011). Training is also found to have significant positive relationship with supporting business process, improving decision making and ensuring survival roles of Computer-Based Information Systems (CBISs) in the study conducted by Fadelelmoula (2018).

The strategic alignment of the ENMCS, which is one of the constructs of the organizational theme, that is addressed through interview revealed that Ethiopia's strategy to the mining sector is bringing foreign direct investment to the mining sector through improving the transparency and the efficiency of the mineral licensing and administration process and to this end the ENMCS is aligned with the mining sector strategy of the country. However, the internal process improvement construct of the operational theme needs to be addressed as departments such as environment, finance and ICT department that have to involve in the licensing and administration process but not yet have access to the ENMCS challenges the mineral licensing and administration's efficiency that the system promised to bring to the sector. The interview finding also revealed that a dedicated user support is not part of an organizational structure both at federal and regional level and ENMCS users are not finding a timely support to resolve system utilization related issues.

“Evaluating system's strategic alignment involves not just the system's support to the firm's strategy but the IT support to the business processes, the IT function status in the company and involvement in business strategy formulation and the management practices that impact alignment” (Tallon, 2008, Rathman, et al., 2005 as cited in Kouki et al., 2009). The interview finding indicated that the ENMCS supports the business strategy for the mining sector which is attracting foreign direct investment (FDI) for exploration and extraction of minerals (National Planning Commission, 2016). Ortega (2016) stated that out of four hundred applications made to

obtain mineral rights between 2010 and 2016 only two hundred were issued showing the lack of efficiency in the mineral licensing process. To this end the ENMCS upgrade to increase the efficiency and transparency can be justified as having business alignment, however the interview finding revealed that there was limited involvement of the ICT directorate of MoMP, which is a serious gap that will affect the post implementation utilization of the ENMCS especially after the end of the support period by the vendor.

The communication within federal level directorates and between federal and regional mining bureaus is a critical area that needs to be addressed as both the survey and the interview findings indicated that the communication in relation with addressing the information gap on the capabilities of the ENMCS and to address the challenges faced by federal and regional level users of the system is weak. Communication is the lowest ranked construct amongst the organizational theme constructs with a mean of mean value of 1.93 which shows disagreement of respondents on being fully informed about the ENMCS using the various communication channels. On the Pearson's correlation result communication is also found to have significant positive correlation with overall satisfaction and perceived usefulness of the ENMCS.

The enabling ICT infrastructure is the major issue that challenges the regional mining bureaus post implementation utilization of the ENMCS as indicated by the interview findings. The inadequacy of the enabling ICT infrastructure coupled with the lack of a dedicated user support with ENMCS related issues both at federal and regional level poses a significant challenge to optimize the ENMCS post implementation utilization to bring the efficiency and transparency to the mineral licensing and administration.

Both pre and post implementation of IS studies have found technological factors as significant predictors of user satisfaction and system utilization (Chwelos et al., 2001; Zhu & Kraemer, 2005; as cited by Al Zoubi, 2018). A post implementation stage is a critical stage where frequent user support request is being made as the interaction of the users with the system increases and they learn about the limitation and bugs in the system which makes the dedicated support team very important (Musaji, 2005; as cited in Kouki et al., 2009). MoMP and regional mining bureaus senior management need to allocate resources to implement and sustain the ICT infrastructure and a dedicated support team that provides real time support to ENMCS users for reliable operationalization of the system both at federal and regional level.

The interview finding indicated that top management commitment has a crosscutting effect in all of the technical, organizational and operational issues that affected the ENMCS post implementation utilization. The regional mining bureaus are more affected by the lack of top management commitment as the interview finding indicated that they are severely affected by the inadequacy of enabling ICT infrastructure and reliable internet connection to access the ENMCS to issue and administer mineral rights. The inadequacy of the ICT infrastructure further aggravates the lack of a follow up training in addition to the one-time classroom based training that the regional users had more than a year ago before the ENMCS go-live in December 2019 as they can't practice on the training site to improve their skill on the various functionalities of the ENMCS. The difference in the level of overall satisfaction using the ENMCS and the perceived usefulness of the ENMCS between federal and regional ENMCS users, which is found to be significant by the independent sample t-test with higher mean level of satisfaction and higher perceived usefulness of the ENMCS for the federal level users could be attributed to the difference in the enabling ICT infrastructure and internet reliability.

Top management commitment remains an important factor for sustaining and promoting the effective system use (Nah and Delgado, 2006; as cited in Kouki et al., 2009). Kouki et al. (2009) also stated that previous studies stressed the importance of the financial support for the post implementation stage to cover costs such as IT infrastructure and system upgrades, training and system resources. Chatterjee et al. (2002) argued that “top management perceptions and attitude towards the system could shape the norms and values of the organization to facilitate (or impede) the system assimilation”. For optimal post implementation utilization of the ENMCS the top management commitment is therefore critical.

In summary the survey and the interview findings answer the three research questions by identifying training, top management commitment, communication, user support, data quality improvement and internal process improvement issues as having an impact on ENMCS post implementation utilization. The multiple linear regression output identifies training construct organizational theme and data quality improvement construct of the operational theme as having a significant positive relationship with both overall satisfaction and ENMCS perceived usefulness. As per the independent sample t-test finding there is a statistically significant difference in the level of user satisfaction and ENMCS perceived usefulness between federal and

regional level ENMCS, with federal level users more satisfied with the ENMCS than the regional users. As per the objective of the study a high level organizational guide to improve the post implementation utilization of the ENMCS is proposed through applying a two dimensional matrix where the identified technical, organizational and operational issues make the vertical axis and the horizontal axis represent the core issues of people, process, technology and top management commitment. The proposed user guide is discussed in section 5.2 below. In the sentence “high level ENMCS post implementation utilization improvement organizational guide”, high level refers to a level that gives a broader solution overview which needs to be refined and prioritized to specific level interventions with measurable outcome to bring the desired organizational improvement in utilizing the ENMCS.

5.2 High level ENMCS post implementation utilization improvement organizational guide

The first appearance of the people, process and technology (PPT) concept is in Information Technology Infrastructure Library (ITIL) framework launched in the 1980s (Prodan et al., 2015). The focus of ITIL is identifying a set of practices in IT that best aligns with the business strategy of an organization to deliver value to the business of the organization (Prodan et al., 2015). PPT are the three areas critical to the overall organizational process improvement (Prodan et al., 2015). The people, process technology dimensions are briefly discussed in the paragraphs below. In addition to the PPT Pordan et al. (2015) suggested customer focus, innovation and management functions as three other areas that are important for overall organizational improvement. Top management perspective and attitude towards an implemented system is the driving force that either facilitate or hinder the system assimilation in the organization Chatterjee et al. (2002). This study treats top management commitment as a fourth dimension, despite the management being part of the people the interview findings suggested that it has an impact on all the constructs under the technical, organizational and operational themes. The four dimensions are briefly discussed below.

Management: Management’s function is achieving an organizational goal through applying the four functions of planning, organizing, leading and controlling (Prodan et al., 2015). The function of management in relation with people involves energizing, empowering, supporting and communicating and to improve organizational process the efficiency of management is key

as process can't work if people don't follow them, process can't also be improved without innovation and technology is the key enabler for innovation (Prodan et al., 2015).

People: People who have the right skill, knowledge, motivation and engagement know what, when and how to perform activities that will contribute to the business objective of the organization and are the most important assets the company has (Prodan et al., 2015).

Processes: A process consists of interrelated steps to get work done in an organization (Nair et al., 2001; as cited in Tadele, 2015). According to the American Society for Quality (ASQ) a process is “a set of interrelated work activities that transform inputs into outputs”.

Technology: Technology includes information systems, information system architectures, hardware and software used to communicate and to make work efficient (Prodan et al., 2015).

The ENMCS post implementation utilization improvement organizational guide is proposed in a matrix format in the table 5.1 below, where the management, people, process and technology dimensions are presented in the horizontal axis and the technical, organization and operational constructs identified through the survey and the interview as impacting the post implementation utilization of the ENMCS at the federal and regional mining bureaus are presented in the vertical axis. The content of the matrix for the ENMCS post implementation utilization user guide is populated from the survey findings, interview findings and previous literatures referred in this study.

Table 5. 1 High level ENMCS post implementation utilization improvement organizational guide

		Management	People	Process	Technology
Organizational Themes	Training	<ul style="list-style-type: none"> • Develop e-learning strategy. • Allocate training fund that is agreed as adequate in consultation with ICT directorate, Licensing directorate and ENMCS vendors. 	<ul style="list-style-type: none"> • Both federal and regional level ENMCS users. • ENMCS Vendor 	<ul style="list-style-type: none"> • Prepare a detailed ENMCS user manual with example datasets. • Prepare task specific tutorial videos. • Add additional functionality on ENMCS training site that administers a competency test for ENMCS users • Provide class room training using the user manual and the example data sets. • Users practice what they trained using the ENMCS user manual and tutorial videos. • Users to take the self-administer competency test to assess their knowledge level • Conduct on-the job training with actual mineral rights data either virtually or in person. • Schedule periodic refresher training to assess and improve the skill level of users. • Monitor the audit log for assuring that user are efficiently utilizing the ENMCS. 	Tutorial Videos, virtual training, online competency test and certification

Operational Themes	Data Quality Improvement	Support the preparation of a data management policy taking input from international best practices and validated with input from users and vendors of the ENMCS and approve the data management policy that governs both federal and regional level ENMCS users.	<ul style="list-style-type: none"> Both federal and regional level ENMCS users 	<ul style="list-style-type: none"> Identify the mineral rights data that causes problem for real time data provision of the ENMCS Prioritize the data sets for cleaning and migration. Prepare a step by step guide for data cleaning Establish federal level and regional level working group Allocate resource for training on data cleaning and migration Conduct the data cleaning and migration 	<ul style="list-style-type: none"> Data cleaning and data migration monitoring dashboard Collaboration and remote support tool
	Internal Process Improvement	<ul style="list-style-type: none"> Map out users who need to be involved in the mineral licensing and administration and inforce role based interaction with the ENMCS Allocate resource for training customization and provision for other departments who need to work on the ENMCS to bring efficiency to the Mineral Licensing and administration process. 	<ul style="list-style-type: none"> Users from Various Directorates at Federal and Regional Mining Bureaus who have a role to play in mineral licensing and administration ENMCS Vendors 	<ul style="list-style-type: none"> Customize a training manual for directorates other than mineral licensing and administration Configure the ENMCS to provide specific role based interaction to directorates such as Environment and Finance Provide the training Monitor the ENMCS usage to improve utilization 	<ul style="list-style-type: none"> Groupware tools for collaboration. Audit log for monitoring system utilization by collaborating directorates in the mineral licensing and administration process.

Technical themes	ICT infrastructure Improvement	<ul style="list-style-type: none"> Request for an audit on the Existing ICT infrastructure at Federal and regional mining bureaus Assess the feasibility of wireless ICT Infrastructure as opposed to wired ICT infrastructure which will be costly and limit mobility. Assess the feasibility of a cloud based back-up option for increasing the reliability of ENMCS production site and e-government portal. Allocate budget to equip regional and federal mineral licensing offices wireless internet access and mobile computing devices. 	<ul style="list-style-type: none"> MoMP ICT Directorate senior experts or Director Federal and regional Level Senior Mineral Licensing and administration experts Licensing and Administration Directors ENMCS vendors Minister/State Minister of Mines 	<ul style="list-style-type: none"> Establish a task force to conduct an in-depth ICT infrastructure gap analysis ICT Infrastructure requirement document (Hardware and Software needs) based on the gap analysis conducted Get expert validation of the gap analysis document to produce a final procurement list and sustainability strategy document. Procure, implement and maintain 	wireless internet options, mobile computing and cloud computing infrastructure for improved system availability

	User Support	Revise the organizational structure and assign a dedicated team either as a separate organizational unit or a unit that is under the ICT directorate to provide on-site and remote support for federal and regional ENMCS users.	Existing ICT directorate staff and newly hired ICT experts to provide support for the ENMCS users	<ul style="list-style-type: none"> • Establishing a support unit with clear roles and responsibilities • Engaging ENMCS vendor to train support unit experts on the type of support that they can provide on the system • Equipping the support unit with tools to provide real time support for all ENMCS users 	Remote support Applications and collaboration tools
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(Source:

Own

Study)

Chapter Six

Conclusion and Recommendation

6.1 Conclusion

Both the survey and the interview revealed that the training construct of the organizational theme is the primary area that should be addressed to improve the ENMCS post implementation utilization. As shown by the multiple regression output there is a significant relationship between training and overall satisfaction and between training and perceived usefulness of the ENMCS. The interview findings revealed that the lack of follow up training to the one-time classroom structured training for regional ENMCS users has shown to affect the utilization of the ENMCS at the regional level.

The training manual for the ENMCS is an area that needs improvement as found from the survey's descriptive analysis 77.94% of the respondents remain neutral on the completeness of the ENMCS user manual. The user manual is not structured in a way that guide ENMCS users to conduct a specific task, moreover it lacks a training data set for users to practice what they trained on in the classroom at the ENMCS training site to sharpen their skill. Moreover, the inadequacy of existing ICT infrastructure and low bandwidth internet to sustainably use the web based ENMCS production site for conducting operational activities and to train on the ENMCS training site.

The second area that should be addressed to improve the ENMCS's real time data provision and that is found critical in affecting the satisfaction of both e-government portal users and ENMCS production site users are the data quality improvement construct of the operational theme. The data quality improvement is found to have a significant positive relationship with ENMCS usage overall satisfaction and with the ENMCS perceived usefulness. As can be seen from the data quality improvement descriptive statistics 47% of respondents are not convinced on the improvement of data accuracy and integrity that is brought by the ENMCS upgrade more than a year after it's go-live. The inaccuracy in real time information provision that is brought about by the challenge of migrating mineral rights data that are issued prior to the ENMCS upgrade is a hindrance to the realization of the ENMCS's potential to bring transparency and efficiency in issuing and administering mineral rights.

The MoMP ICT directorate's lack of involvement in the ENMCS upgrade and the none existence of ENMCS support unit in the MoMP's organizational structure are causing major challenge in addressing ENMCS related issues the regional and federal level users face. The current practice of alerting the federal mineral licensing and administration director on challenges faced by regional and federal level users to communicate the vendor to sort them will delay the timely resolution of issues as the director could be engaged in day to day operational issues to follow up with vendors. Moreover, the lack of sustainability plan that involves the ICT directorate of MoMP and dedicated user support team after the support period of the vendor ends in February 2022 should be given immediate top management attention.

Top management commitment has an impact on all the constructs of the technical, organizational and operational themes. The descriptive statistics of the top management commitment construct showed that it is the second construct with the lowest mean of means that showed respondents' disagreement of top management's commitment to improve post-implementation utilization of the ENMCS. The interview finding showed that the lack of adequate financial and human resource allocation through top management commitment seriously affected the provision of training, data quality improvement, improving the ICT infrastructure at regional mining bureaus, involving the ICT directorate on the business strategy & ENMCS alignment and recognizing & rewarding ENMCS users that persistently use the ENMCS to issue and administer mineral rights and support their colleagues when they encounter challenges while using the ENMCS.

6.2 Recommendation

To improve the effectiveness of the ENMCS training it is important to improve the ENMCS user manual, which needs to be structured in a way that assists users on accomplishing specific tasks on the ENMCS training site using a training data set. In addition to the manual tutorial videos on how to accomplish specific tasks on the ENMCS production site will encourage ENMCS users to practice what they are trained on. Moreover, there needs to be a plan to periodically conduct a refresher training for both regional and federal level ENMCS users and a self-administered competency test on accomplishing specific tasks on the ENMCS training site to assess the proficiency of ENMCS users.

The data quality improvement which is crucial for informed decision making both by mineral rights holders, new applicants, licensing experts and top management can be addressed by establishing a data cleaning working group that include both federal and regional level ENMCS users, setting a criteria for prioritizing existing mineral licenses with data quality issue, prioritizing the licenses based on the criteria, chose a virtual collaboration tool followed by cleaning and migrating the mineral rights data into the upgraded ENMCS collaboratively. Management should allocate resource and closely monitor the data cleaning process through a data cleaning dashboard to ensure a timely data cleaning and migration is completed for all the licenses issued at the federal and regional level.

Enabling ICT infrastructure and an organizational structure that incorporates a dedicated user support and bring on board other departments who have a role to play in the mineral licensing and administration process to achieve internal process improvement are mandatory to promote the sustainable post implementation utilization of the ENMCS. Dedicated wireless and mobile computing devices can be provided to regional mineral licensing and administration officers to alleviate sharing a low band width wired connection with other departments. Allocating a budget to accommodate a dedicated user support group at MoMP, trained by the ENMCS vendor on the type and level of support that can be provided nationally without the vendor's involvement after the support period not only saves MoMP money but also insures national capacity building. Moreover, there needs to be a tailored training and provision of role based interaction access to departments like finance and environment who have a role to play in the mineral licensing and administration process to bring the desired internal process improvement and efficiency.

The inefficiency in communication needs to be addressed through adopting suitable groupware tools that not only improve communication but also foster collaboration between federal and regional level ENMCS users. Once agreed communication tools are in place, management and tech savvy ENMCS users should advocate and bring on board less active communicators to enable efficient communication on ENMCS updates, additional functional requirements and support required on the existing functionalities.

Top management commitment has an impact not only on organizational issues but also on technical and operation issues that affect ENMCS post implementation utilization. To

efficiently carry out training for federal and regional level ENMCS users, top management's commitment in showing visible leadership and support to the successful utilization of the ENMCS is critical. Moreover, top management should also avail financial resources for training, putting in place enabling ICT infrastructure, adjusting an organizational structure to accommodate a dedicated ENMCS user support, recognizing and rewarding users that show dedication and persistently use ENMCS to issue and administer mineral rights and provide support for their colleagues to improve the utilization of the ENMCS at their department.

As a future research direction the proposed research model could be retested with more population size in one-year time where zonal and woreda level mineral licensing and administration experts are expected to become users of the ENMCS. Mediating variables that have an impact on the relationship between the constructs of the technical and organizational themes and overall satisfaction and perceived usefulness that are rejected through the multiple linear regression of this study could be an area for future study. It is also worth conducting a comparative study between African countries that are using cadaster based mineral licensing and administration system on organizational and operational issues that affect post-implementation utilization with the aim of finding a solution that can be contextualized to resolve the underutilization of mineral rights management systems after their expensive development and implementation.

Reference

Al-Yaseen, H., Al-Jaghoub, S. Al-Shorbaji, M. and Salim, M. (2010) “Post-Implementation Evaluation of HealthCare Information Systems in Developing Countries” *The Electronic Journal Information Systems Evaluation* Volume 13 Issue 1, pp 9 – 16

Al-Zoubi, .M (2018). The Role of Technology, Organization, and Environment Factors in Enterprise Resource Planning Implementation Success in Jordan. *International Business Research*; Vol. 11, No. 8

American Society for Quality, *QUALITY GLOSSARY - P* (2021). [Letter P - Quality Glossary of Terms, Acronyms & Definitions with Letter P | ASQ](#) 17 May 2021.

Becky, S. (2019). Everything You Need to Know about the People, Process, Technology Framework. <https://www.smartsheet.com/content/people-process-technology> accessed on 4 May 2021.

Backaitis, V. (2013). Open Source vs. Proprietary Software: There is No Clear Winner. <https://www.cmswire.com/cms/information-management/open-source-vs-proprietary-software-there-is-no-clear-winner-021752.php> accessed on 3 January 2021.

Badea, A. C., and Badea, G. (2018). *CONSIDERATIONS ON OPEN SOURCE GIS SOFTWARE VS PROPRIETARY GIS SOFTWARE*. GEOCAD. Alba Iulia, Romania. January 2018.

Baker, Jeff. (2011). The Technology–Organization–Environment Framework. 10.1007/978-1-4419-6108-2_12.

Bhattacharjee, A., & Premkumar, G. (2004). Understanding Changes in Belief and Attitude Toward Information Technology Usage: A Theoretical Model and Longitudinal Test. *MIS Q.*, 28, 229-254.

Feast, B., Davids, J., Mills, T. and De Vries, P. (2006). Mining Cadastre in Africa – Lessons Learnt. 5th FIG Regional Conference. Accra, Ghana, March 8-11, 2006

Chatterjee, D., Grewal, R. and Sambamurthy, V. (2002). Shaping up for e-commerce: Institutional enablers of the organizational assimilation of Web technologies, *MIS Quarterly*, Vol. 26, No. 2, pp. 65–89.

Creswell, J.W. (2009). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. ISBN978-1-4129-6556-9(cloth)

Creswell, J.W. (2013). *Qualitative Inquiry and Research Design: Choosing Among Five approaches*. ISBN 978-1-4129-9531-3 (cloth)

- David, M., Clarke, M. and Baxter, J. (2008). Evaluating land administration projects in developing countries. *Land Use Policy* 25 (2008) 464–473. DOI: 10.1016/j.landusepol.2007.10.004
- Dawidowicz, A., Żróbek, R. (2017). Land Administration System for Sustainable Development - Case Study of Poland, *Real Estate Management and Valuation*, vol. 25, no. 1, pp. 112-122.
- Delone, William & McLean, Ephraim. (2002). Information Systems Success Revisited. Hawaii International Conference on System Sciences. 8. 238. 10.1109/HICSS.2002.994345.
- Delvin, G and Ojelanki, N. (2003). A report on the use of action research to evaluate a manufacturing systems development methodology in a company. DOI: 10.1046/j.1365-2575.2003.00137.
- Deininger, K., Daniel, A.A., Tekie, A. (2008). Impacts of Land Certification On Tenure Security, Investment, And Land Markets. The World Bank Development Research Group Sustainable Rural and Urban Development Team, 2008.
- Dezdar, S. & Sulaiman, A. (2011). The influence of organizational factors on successful ERP implementation. *Management Decision*. 49. 911-926. 10.1108/00251741111143603.
- Eldabi, T., Paul, R.J. and Sbeih, H. (2003). Operational use evaluation / post implementation evaluation of IT, UKAIS, 2003, Warwick.
- Elia, E & Zevenbergen, J. & Lemmen, C & Oosterom, P. (2013). The Land Administration Domain Model (LADM) as the reference model for the Cyprus Land Information System (CLIS). *Survey Review*. 45. 100-110. 10.1179/1752270611Y.0000000034.
- Elsa Taddele (2015). ERP Post Implementation Management Framework: The case of Ethiopian Airlines.
- Enemark, S. (2009). Sustainable Land Administration Infrastructures to support Natural Disaster Prevention and Management. UN REGIONAL CARTOGRAPHIC CONFERENCE FOR THE AMERICAS NEW YORK, 10-14 AUGUST 2009.
- Enrique Ortega (2016). *DIAGNOSTIC ASSESSMENT OF MINERAL CADASTRE. Internal Report Ministry of Mines and Petroleum: Unpublished.*
- Eftychia, K., Oosteom, P., Dimopoulou, E. and Christiaan, L. (2020). 3D Land Administration: A Review and a Future Vision in the Context of the Spatial Development Lifecycle, *ISPRS Int. J. Geo-Inf.* 2020, 9, 107
- Fadelelmoula, A. A. (2018). The effects of the critical success factors for ERP implementation on the comprehensive achievement of the crucial roles of information systems in the higher education sector. *Interdisciplinary Journal of Information, Knowledge, and Management*, 13, 21-44. <https://doi.org/10.28945/3942>

Fred, D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *Management Information Systems Quarterly*, Vol.13, No.3, pp. 319-340.

Freudenberger, M. and Harvey, E. (2014). PROPERTY RIGHTS AND ARTISANAL DIAMOND DEVELOPMENT II (PRADD II) GUINEA – MINING CADASTRE SYSTEM ASSESSMENT. Prepared by Tetra Tech for the United States Agency for International Development, USAID Contract No. AID-OAA-I-12-00032/AID/OAA-TO-13-00045, under the Strengthening Tenure and Resource Rights (STARR) Indefinite Quantity Contract (IQC).

Guest G, Namey E, Chen M (2020) A simple method to assess and report thematic saturation in qualitative research. *PLOS ONE* 15(5): e0232076. <https://doi.org/10.1371/journal.pone.0232076>

Gustafsson, J. (2017). Single case studies vs. multiple case studies: A comparative study.

Guy, G., Sedera, D. and Chan, T. (2008). Re-conceptualizing information system success: The IS-Impact measurement model. *Journal of the Association for Information Systems*, 9(7): 377-408.

Gebeyehu, B., Fuchs, H. and Mansberger, R. (2015). Lessons from Systematic Evaluation of Land Administration Systems: The Case of Amhara National Regional State of Ethiopia. *World Development* Vol. 68, pp. 282–295

Hernandez A. (2003). Mining Cadastre in Tanzania. FIG Working Week 2003, Paris, France.

Ismail, N., Yatin, M.F.S, & Abdul Kadir, R. (2014). An Empirical Study On Effectiveness of ERP System. *Australian Journal of Basic and Applied Sciences*, 8(23) Special 2014, Pages: 144-150

Izham, J. M., Sidi, F., Ishak, I. and Affendey, S.L. (2017). A REVIEW OF DATA QUALITY RESEARCH IN ACHIEVING HIGH DATA QUALITY WITHIN ORGANIZATION. *Journal of Theoretical and Applied Information Technology*. vol.95. No 12

Ke, Weiling and Wei, K.K. (2008). Organizational Culture and Leadership in ERP Implementation. *Decision Support Systems*, Vol. 45, No. 2, pp. 208-218.

Kepes, B. (2013). Open Source Is Good and All, But Proprietary Is Still Winning. <https://www.forbes.com/sites/benkepes/2013/10/02/open-source-is-good-and-all-but-proprietary-is-still-winning/?sh=14932388637a> accessed on 5 January 2021.

Kouki, R., Poulin, D. and Pellerin, R. (2009). Determining Factors of ERP Assimilation: Exploratory Findings from a Developed and a Developing Country.

Krigsholm, P., Riekkinen, K., & Ståhle, P. (2018). The Changing Uses of Cadastral Information: A User-Driven Case Study. *Land*, 7(3), 83; <https://doi.org/10.3390/land7030083>

Kushniruk, A., Elizabeth, M. Borycki, M.E. and Kannry, J. (2009). Exploring the relationship between training and usability: A study of the impact of usability testing on improving training

and system deployment. Article in *Studies in Health Technology and Informatics*. DOI: 10.3233/978-1-58603-979-0-277

Lemmen, C., Oosterom, P. and Bennett, R. (2015). The Land Administration Domain Model. *Land Use Policy* Volume 49 (2015) 535–545 <https://doi.org/10.1016/j.landusepol.2015.01.014>.

L. Willcocks (1992). Evaluating Information Technology investments: research findings and reappraisal. *Information Systems Journal*, Volume2, Issue4, P 243-268.

Lee, D.H., Lee, S.M., Olson, D.L. and Chung, S.H. (2010), “The effect of organizational support on ERP implementation”, *Industrial Management & Data Systems*, Vol. 110, No.1/2, pp. 269-83.

Nunnally (1978). *Psychometric Theory*, 2d ed., New York: McGraw-Hill, p. 245

National Planning Commission (2016). Federal Democratic Republic of Ethiopia, Growth and Transformation Plan II (GTP II), pp. 151-152

Obeng, R. (2015). An Exploration of the Case Study Methodological Approach through Research and Development. DOI: 10.13140/RG.2.2.18359.11684

Ogundipe OY and Opafunso ZO (2016). Effects of Cadastral System on Mining Title Administration in Nigeria. *Social Sci J* 7: 161. doi:10.4172/2151-6200.1000161

Oosterom, P., Groothedde, A., Lemmen, C., Molen, P. and Uitermark, H. (2009). Land Administration as a Cornerstone in the Global Spatial Information Infrastructure, *International Journal of Spatial Data Infrastructures Research*, Vol. 4.

Pallant, J. (2016). *SPSS Survival Manual*. Copyright © Julie Pallant, 2016.

Perera, H.S.C. and T. Withanage (2008). Critical Success Factors in Post ERP Implementation. *The Institution of Engineers, Sri Lanka, ENGINEER* - Vol. XXXXI, No. 03, pp. 29 - 36

Petter, S., DeLone, W. and McLean, E. (2008). Measuring information systems success: models, dimensions, measures and interrelationships. *European Journal of Information Systems* (2008) 17, 236–263. doi:10.1057/ejis.2008.15

Prodan, M., Prodan, A. and Purcarea, A.A. (2015). Three new dimensions to People, Process, Technology improvement model. Three New Dimensions to People, Process, Technology Improvement Model. *Advances in Intelligent Systems and Computing*. 353. 481-490. 10.1007/978-3-319-16486-1_47.

Sam-Okomgboeso, M., Argyropoulou, M. and Ankrah, S. (2011). An investigation into the effect of organizational support on user acceptance of ERP during the routine stage.

Shirzad, Mehrdad & Babaie, Hassan & Kiani, Sara & Navi, Maryam & Gholami, Hessam & Arefipour, S. & Fouladi, N. & Motevali, Kamran. (2014). Framework and modeling structure of Exploration and Mining Cadastre system in Iran. *Earth Science Informatics*. 7. 123-138. 10.1007/s12145-014-0150-x.

Spatial Dimension (2008). FlexiCadastre Selected by World Bank for Ethiopian Mining Cadastre System, Retrieved from <https://landadmin.trimble.com/2008/04/01/flexicadastre-selected-by-world-bank-for-ethiopian-mining-cadastre-system/> accessed on 14 December 2020.

Somers, T.M. Nelson, K., Karimi, J. (2003). Confirmatory factor analysis of the end-user computing satisfaction instrument: replication within an ERP domain. *Decision Sciences*, Vol. 34 No.3

Scott, J.E. (2005). Post-Implementation Usability of ERP Training Manuals: The user's Perspective. *Information Systems Management*, Vol. 22, No. 2, pp. 67-77.

Theron, P.M. (2015). Coding and data analysis during qualitative empirical research in Practical Theology. In *die Skriflig* 49(3), Art. #1880,9 pages. <http://dx.doi.org/10.4102/ids.v49i3.1880>

Thomas, T.D., Singh, L. and Gaffar, K. (2013). The utility of the UTAUT model in explaining mobile learning adoption in higher education in Guyana. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 2013, Vol. 9, Issue 3, pp. 71-85.

Trimble (2018). Ethiopia Mineral Cadaster Database Management System (MCDMS) Upgrade. *Internal Report Ministry of Mines and Petroleum: Unpublished.*

Westbrook, J. Braithwaite, J., Iedema, R. Enrico and W Coiera (2004). Evaluating the impact of information communication technologies on complex organizational systems: a multi-disciplinary, multi-method framework.

Williamson, I., Enemark, S., Wallace, J. and Rajabifard, A. (2009). Land Administration for sustainable development.

Xu, H. (2019). ERP Implementation Satisfaction - A Data Quality Approach. *Journal of Technology Research*, Volume 8.

Yin, R. K. (2003). *Case Study Research Design and Methods.*

Zein, T. (2016). FIT-FOR-PURPOSE LAND ADMINISTRATION: AN IMPLEMENTATION MODEL FOR CADASTRE AND LAND ADMINISTRATION SYSTEMS. Annual World Bank Conference on Land and Poverty, Washington DC, 2016.

Zein, T., Timm, C. and Hartie, P. (2015). CONCEPT, DESIGN AND DEVELOPMENT OF LAND ADMINISTRATION AND CADASTRE SYSTEMS USING OPEN SOURCE SOFTWARE, Annual World Bank Conference on Land and Poverty, Washington DC, 2015.

Appendices

Appendix A: Questionnaire Survey

**Addis Ababa University
School of Graduate Studies College of Natural Science
Department of Information Science**

Dear Sir/Madam:

In partial fulfillment of the requirements for the Degree of Master of Science in Information Systems, I am undertaking a research on “Ethiopian National Mining Cadastre System (ENMCS)

Post Implementation Success Factors: The Case of Ministry of Mines of Ethiopia and Regional Mines Bureaus” at Addis Ababa University. This survey questionnaire is prepared to investigate technical, organizational, and operational issues that are affecting the utilization of the ENMCS at the federal and regional Level. The ENMCS is simply referred as the cadastre system in the Likert items of the survey questionnaire.

This research is believed to produce recommendations and a post implementation management framework that can improve the utilization of the ENMCS at the federal and regional mines bureaus of Ethiopia.

Your honest responses to each question and statement are extremely valuable to the outcome of this research. The questionnaire survey will take approximately 20 minutes to complete and the results of the survey will be used for the purpose of academic research only. Hence, all responses will be kept confidential and the respondents of the survey will be kept anonymous in analyzing and interpreting the data and reporting the findings.

I would like to take this opportunity to thank you in advance for your kind participation, genuine and on time response to the questionnaire.

Thank you again!

Fitsum Assefa

Demographic Information

1. Name (Optional) _____

2. Directorate/Section _____

3. Your Position (Choose One)

Director

Deputy Director

Junior Expert

Expert

Senior Expert

4. Experience working on Mineral Licensing and Administration (Choose One)

Less than 2 years

2 – 5 years

6 – 10 years

11 – 15 years

More than 15 years

5. Gender

Male Female

The Likert Scale Items below are adopted from IS literatures and contextualized to suite the purpose of the study. Please choose only one and circle your response to show your level of agreement or disagreement for each Likert Item;

1 = Strongly Disagree

2= Disagree

3= Neither agree nor Disagree

4= Agree and

5= Strongly agree

Technical Theme – The Likert items under this theme are intended to measure the attributes of the cadastre system that qualifies it as being a quality system that provides quality information.

1	The cadastre system provides accurate and reliable information.	1	2	3	4	5
2	The cadastre system provides up-to-date information.	1	2	3	4	5
3	The cadastre system fulfills all the functional requirements to issue and administer mineral licenses.	1	2	3	4	5
4	It is easy to learn how to use the cadaster system	1	2	3	4	5
5	The cadastre system is flexible in terms of system use (e.g. it is easy to modify the content and format of the system and related outputs)	1	2	3	4	5
6	The cadastre system is flexible enough to be properly modified to meet new business requirements. (eg. When there is an amendment in mining proclamation and regulation the cadastre can be customized to reflect those changes)	1	2	3	4	5
7	The cadastre system can be integrated with systems that are relevant for mineral licensing and administration (eg. With banks to facilitate various modes of payment, with systems that provide spatial information)	1	2	3	4	5

Organizational Theme – The Likert items under this theme are intended to measure top management commitment, training adequacy and suitability, effectiveness of communication and the usefulness of the cadastre user manual.

		1	2	3	4	5
1	My immediate supervisor allows me the time to attend cadastre system related training sessions.	1	2	3	4	5
2	My immediate supervisor discusses with me about how the cadastre system impacts my work processes or tasks.	1	2	3	4	5
3	My immediate supervisor checks on the cadastre system before approving the issuance of a new license or renewing existing license.	1	2	3	4	5
4	My immediate supervisor encourages me to practice on the cadastre system training site and recognizes my effort.	1	2	3	4	5
5	The kind of training provided to me was comprehensive enough for me to start using the cadastre system.	1	2	3	4	5
6	My level of understanding about the cadastre substantially improved after going through the cadastre training.	1	2	3	4	5
7	The training gave me confidence to start using the cadastre system	1	2	3	4	5

8	The trainers were knowledgeable and helped me in my understanding of the cadastre system.	1	2	3	4	5
9	I was well informed about upgrades, unavailability and changes in the cadastre system through email.	1	2	3	4	5
10	I was well informed about upgrades and changes in the cadastre system through my immediate supervisor or Ministry of mines focal persons.	1	2	3	4	5
11	I was well informed about upgrades and changes in the cadastre system through workshops or presentations.	1	2	3	4	5
12	The content and index of the cadastre user manual are useful.	1	2	3	4	5
13	The cadastre user manual is current and up to date.	1	2	3	4	5
14	The cadastre user manual is complete.	1	2	3	4	5

Operational Theme – The Likert items under this theme are intended to measure the data quality improvement as high quality data at the core of the cadastre system’s ability to produce information for timely decision making.

1	The data output from the cadastre system is appropriate and complete.	1	2	3	4	5
2	Incorrect data input can be instantly discovered by the cadaster system.	1	2	3	4	5
3	The cadastre system users understand the concept and the value of integrated data for issuing and administering mineral rights licenses.	1	2	3	4	5
4	Data accuracy and integrity has been improved by using the cadastre system.	1	2	3	4	5

Perceived usefulness of the cadastre system

1	Using the cadastre system will make my work more efficient (e.g. reducing the time required for performing mineral licensing and administration tasks, making work easier, eliminating overlaps).	1	2	3	4	5
2	Using the cadastre system will increase my job performance.	1	2	3	4	5
3	Using the cadastre system will increase the productivity of my work.	1	2	3	4	5
4	Using the cadastre system will enable me to increase the efficiency of my decision-making (e.g. I can make decisions at a faster pace)	1	2	3	4	5

Overall satisfaction of the cadastre system

	Overall I am satisfied with the cadastre system	1	2	3	4	5
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Appendix B: Interview Outline

1. What is your perception of the cadastre system in terms of meeting your current functional requirement with regards to mineral rights granting and administration?
2. Do you think the cadastre system is strategically aligned with the business need for Ethiopian mining sector? If it is aligned how can it be described? If it is not aligned what suggestions do you have?
3. How easy do you think it is to accommodate changes on the cadastre system for future changes in the mineral rights granting and administration?
4. Is the cadastre system easily integrable with other system that will improve or enhance production and portal site users of the cadastre system?
5. How do you describe the cadastre vendor's responsiveness to support requests from Federal and regional mining bureaus?
6. How do you describe the relationship between the cadastre vendor and the ICT department of MoMP and regions?
7. Who do you communicate if you run into a challenge when using the cadastre system?
8. Is there a dedicated help desk at the federal or regional level to support you with your challenges or queries regarding the cadastre system?
9. Does the top management provide you with the support you need to efficiently utilize the cadastre system?
10. What kind of support do you think are currently missing from the top management?
11. How is the production site training structured?
12. Are the trainers knowledgeable and competent?
13. Is the training manual easy to use and designed in a way to assist the cadaster system user address specific challenges?
14. Do you think the user manual is complete to guide a novice user issue new mineral rights and administer existing mineral rights?
15. What channels of communication does the cadastre system users at federal and regional level use for Cadastre related issues?
16. How efficient are the cadastre system users in utilizing the communication channels to communicate cadastre related issues?
17. Does the cadastre system improve the internal processes at the federal and regional mineral licensing and administration offices?

18. Does the cadaster provide real-time and up-to-date information on mineral rights?
19. Are there any challenges to migrate historical mineral rights data into the cadastre system?
20. Overall how satisfied are you with the cadaster system?

Appendix C: Demographic Data of the Survey

Directorate/Section/Region	Current Position	Level of Education	Experience working on Mineral Licensing and Administration	Gender
Amhara Region	Director	First Degree	6 – 10 years	Male
SNNP Region	Senior Expert	First Degree	6 – 10 years	Male
Oromia Region	Expert	Masters Degree	2 – 5 years	Male
Amhara Region	Expert	First Degree	2 – 5 years	Male
Oromia Region	Senior Expert	Masters Degree	11 – 15 years	Male
Oromia Region	Junior Expert	First Degree	Less than 2 years	Female
Dire Dawa City Administration	Director	First Degree	11 – 15 years	Male
Oromia Region	Expert	First Degree	6 – 10 years	Female
Dire Dawa City Administration	Senior Expert	First Degree	6 – 10 years	Male
SNNP Region	Senior Expert	First Degree	6 – 10 years	Male
Oromia Region	Junior Expert	First Degree	Less than 2 years	Female
SNNP Region	Senior Expert	First Degree	6 – 10 years	Male
Amhara Region	Expert	First Degree	2 – 5 years	Female
Amhara Region	Junior Expert	First Degree	Less than 2 years	Male
SNNP Region	Expert	First Degree	2 – 5 years	Female
Dire Dawa City Administration	Expert	First Degree	6 – 10 years	Male
Harari Region	Senior Expert	First Degree	6 – 10 years	Male
SNNP Region	Senior Expert	First Degree	2 – 5 years	Male
SNNP Region	Expert	Masters Degree	2 – 5 years	Male
SNNP Region	Junior Expert	First Degree	Less than 2 years	Male
Harari Region	Expert	First Degree	2 – 5 years	Female
Somali Region	Senior Expert	Masters Degree	6 – 10 years	Male
Dire Dawa City Administration	Expert	First Degree	2 – 5 years	Male
Harari Region	Expert	First Degree	2 – 5 years	Male
Afar Region	Expert	First Degree	6 – 10 years	Male
Afar Region	Director	First Degree	11 – 15 years	Male
Afar Region	Senior Expert	First Degree	6 – 10 years	Male
Somali Region	Director	Masters Degree	More than 15 years	Male
Somali Region	Senior Expert	First Degree	11 – 15 years	Male
Benishangul Region	Expert	First Degree	6 – 10 years	Male
Gamble Region	Director	Masters Degree	More than 15 years	Male
Benishangul Region	Director	First Degree	6 – 10 years	Male
Addis Ababa City Administration	Expert	First Degree	6 – 10 years	Male
Addis Ababa City Administration	Senior Expert	First Degree	11 – 15 years	Male
Gamble Region	Senior Expert	First Degree	More than 15 years	Male
Benishangul Region	Expert	First Degree	2 – 5 years	Male
Addis Ababa City Administration	Senior Expert	Masters Degree	More than 15 years	Female
Benishangul Region	Expert	First Degree	6 – 10 years	Male
M01	Director	Masters Degree	More than 15 years	Male
M02	Senior Expert	Masters Degree	More than 15 years	Male
M03	Expert	First Degree	2 – 5 years	Male
M04	Senior Expert	First Degree	More than 15 years	Male

Directorate/Section/Region	Current Position	Level of Education	Experience working on Mineral Licensing and Administration	Gender
M05	Senior Expert	First Degree	11 – 15 years	Male
M06	Expert	Masters Degree	6 – 10 years	Female
M07	Senior Expert	First Degree	11 – 15 years	Female
M08	Junior Expert	First Degree	Less than 2 years	Male
M09	Director	Masters Degree	11 – 15 years	Female
M10	Expert	First Degree	2 – 5 years	Female
M11	Junior Expert	First Degree	Less than 2 years	Male
M12	Expert	First Degree	2 – 5 years	Male
M13	Expert	First Degree	2 – 5 years	Male
M14	Expert	First Degree	2 – 5 years	Male
M15	Senior Expert	First Degree	6 – 10 years	Male
M16	Expert	Masters Degree	2 – 5 years	Male
M17	Senior Expert	Masters Degree	11 - 15 years	Male
M18	Expert	First Degree	6 – 10 years	Male
M19	Junior Expert	First Degree	Less than 2 years	Male
M20	Expert	First Degree	2 - 5 years	Male
M21	Senior Expert	First Degree	6 – 10 years	Female
M22	Expert	First Degree	6 – 10 years	Female
M23	Expert	First Degree	2 – 5 years	Female
M24	Expert	First Degree	6 – 10 years	Male
M25	Senior Expert	First Degree	More than 15 years	Male
M26	Expert	First Degree	6 – 10 years	Male
M27	Junior Expert	First Degree	Less than 2 years	Female
M28	Expert	First Degree	2 – 5 years	Female
M30	Senior Expert	First Degree	More than 15 years	Male
M31	Senior Expert	Masters Degree	More than 15 years	Male

Appendix D: ENMCS Attribute Construct of the Technical Theme Survey Response

Directorate/Section/Region	Provides accurate and reliable information.	Provides up-to-date information.	Fulfills all the functional requirements	It is easy to learn how to use the cadaster system	Flexible in terms of system use	Flexible enough to be properly modified to meet new business requirements	Can be integrated with other systems
Amhara Region	Agree	Agree	Neutral	Agree	Agree	Neutral	Agree
SNNP Region	Agree	Disagree	Neutral	Disagree	Neutral	Disagree	Neutral
Oromia Region	Neutral	Neutral	Agree	Neutral	Neutral	Disagree	Agree
Amhara Region	Neutral	Disagree	Neutral	Disagree	Neutral	Disagree	Neutral
Oromia Region	Neutral	Disagree	Neutral	Neutral	Neutral	Disagree	Neutral
Oromia Region	Agree	Neutral	Agree	Agree	Neutral	Disagree	Neutral
Dire Dawa City Administration	Agree	Neutral	Neutral	Agree	Agree	Disagree	Agree
Oromia Region	Agree	Neutral	Neutral	Agree	Neutral	Disagree	Neutral
Dire Dawa City Administration	Disagree	Disagree	Neutral	Neutral	Strongly Disagree	Disagree	Neutral
SNNP Region	Agree	Disagree	Neutral	Disagree	Neutral	Disagree	Neutral
Oromia Region	Neutral	Neutral	Neutral	Disagree	Neutral	Strongly Disagree	Disagree
SNNP Region	Agree	Agree	Neutral	Agree	Agree	Neutral	Neutral
Amhara Region	Neutral	Neutral	Agree	Neutral	Neutral	Neutral	Neutral
Amhara Region	Neutral	Neutral	Neutral	Neutral	Neutral	Disagree	Neutral
SNNP Region	Neutral	Neutral	Agree	Agree	Agree	Neutral	Neutral
Dire Dawa City Administration	Neutral	Disagree	Neutral	Disagree	Neutral	Disagree	Neutral
Harari Region	Agree	Disagree	Disagree	Disagree	Neutral	Disagree	Neutral
SNNP Region	Agree	Neutral	Agree	Agree	Neutral	Disagree	Neutral
SNNP Region	Disagree	Disagree	Neutral	Disagree	Strongly Disagree	Disagree	Disagree
SNNP Region	Neutral	Neutral	Agree	Neutral	Neutral	Disagree	Disagree
Harari Region	Disagree	Disagree	Neutral	Neutral	Strongly Disagree	Disagree	Disagree
Somali Region	Neutral	Disagree	Neutral	Disagree	Neutral	Disagree	Disagree
Dire Dawa City Administration	Agree	Disagree	Agree	Disagree	Neutral	Disagree	Neutral
Harari Region	Neutral	Neutral	Agree	Neutral	Neutral	Disagree	Neutral
Afar Region	Disagree	Disagree	Neutral	Neutral	Strongly	Disagree	Disagree

Directorate/Section/Region	Provides accurate and reliable information.	Provides up-to-date information.	Fulfills all the functional requirements	It is easy to learn how to use the cadaster system	Flexible in terms of system use	Flexible enough to be properly modified to meet new business requirements	Can be integrated with other systems
					Disagree		
Afar Region	Neutral	Disagree	Neutral	Neutral	Neutral	Strongly Disagree	Disagree
Afar Region	Neutral	Disagree	Neutral	Neutral	Neutral	Disagree	Disagree
Somali Region	Neutral	Neutral	Agree	Neutral	Neutral	Disagree	Neutral
Somali Region	Disagree	Disagree	Neutral	Neutral	Disagree	Disagree	Neutral
Benishangul Region	Disagree	Disagree	Neutral	Neutral	Disagree	Disagree	Disagree
Gamble Region	Neutral	Disagree	Neutral	Neutral	Neutral	Disagree	Disagree
Benishangul Region	Disagree	Disagree	Neutral	Neutral	Strongly Disagree	Disagree	Neutral
Addis Ababa City Administration	Neutral	Disagree	Neutral	Disagree	Disagree	Disagree	Neutral
Addis Ababa City Administration	Disagree	Disagree	Neutral	Neutral	Strongly Disagree	Disagree	Neutral
Gamble Region	Neutral	Disagree	Neutral	Neutral	Neutral	Disagree	Neutral
Benishangul Region	Disagree	Disagree	Disagree	Neutral	Strongly Disagree	Disagree	Neutral
Addis Ababa City Administration	Neutral	Neutral	Agree	Agree	Neutral	Neutral	Disagree
Benishangul Region	Neutral	Disagree	Neutral	Disagree	Disagree	Disagree	Disagree
M01	Disagree	Disagree	Neutral	Neutral	Strongly Disagree	Disagree	Neutral
M02	Agree	Agree	Neutral	Agree	Neutral	Neutral	Neutral
M03	Disagree	Disagree	Neutral	Neutral	Strongly Disagree	Disagree	Disagree
M04	Agree	Neutral	Neutral	Agree	Neutral	Neutral	Neutral
M05	Agree	Neutral	Agree	Agree	Agree	Neutral	Neutral
M06	Agree	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
M07	Neutral	Neutral	Neutral	Neutral	Neutral	Disagree	Agree
M08	Agree	Agree	Neutral	Agree	Neutral	Neutral	Neutral

Directorate/Section/Region	Provides accurate and reliable information.	Provides up-to-date information.	Fulfills all the functional requirements	It is easy to learn how to use the cadaster system	Flexible in terms of system use	Flexible enough to be properly modified to meet new business requirements	Can be integrated with other systems
M09	Strongly Agree	Agree	Agree	Agree	Neutral	Agree	Agree
M10	Disagree	Disagree	Disagree	Neutral	Strongly Disagree	Disagree	Disagree
M11	Agree	Agree	Agree	Agree	Neutral	Agree	Neutral
M12	Agree	Agree	Neutral	Agree	Neutral	Agree	Neutral
M13	Strongly Agree	Agree	Agree	Agree	Neutral	Agree	Neutral
M14	Agree	Neutral	Neutral	Disagree	Neutral	Neutral	Neutral
M15	Strongly Agree	Agree	Agree	Strongly Agree	Strongly Agree	Agree	Agree
M16	Agree	Disagree	Neutral	Disagree	Neutral	Disagree	Disagree
M17	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Agree
M18	Agree	Agree	Neutral	Agree	Neutral	Agree	Neutral
M19	Neutral	Disagree	Neutral	Neutral	Neutral	Disagree	Disagree
M20	Agree	Neutral	Agree	Agree	Neutral	Neutral	Disagree
M21	Disagree	Disagree	Neutral	Disagree	Strongly Disagree	Disagree	Disagree
M22	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Agree	Agree
M23	Agree	Neutral	Agree	Agree	Neutral	Agree	Neutral
M24	Disagree	Disagree	Disagree	Disagree	Strongly Disagree	Disagree	Neutral
M25	Disagree	Disagree	Disagree	Disagree	Strongly Disagree	Disagree	Disagree
M26	Agree	Disagree	Agree	Disagree	Neutral	Disagree	Neutral
M27	Disagree	Disagree	Disagree	Neutral	Strongly Disagree	Disagree	Disagree
M28	Strongly	Neutral	Agree	Strongly	Strongly Agree	Agree	Agree

Directorate/Section/Region	Provides accurate and reliable information.	Provides up-to-date information.	Fulfills all the functional requirements	It is easy to learn how to use the cadaster system	Flexible in terms of system use	Flexible enough to be properly modified to meet new business requirements	Can be integrated with other systems
	Agree			Agree			
M30	Strongly Agree	Agree	Agree	Agree	Agree	Agree	Agree
M31	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Agree	Agree	Neutral

Appendix E: Top Management Commitment Construct of the Organizational Theme Survey Response

Directorate/Section/Region	My immediate supervisor allows me the time to attend cadastre system related training sessions.	My immediate supervisor discusses with me about how the cadastre system impacts my work processes or tasks.	My immediate supervisor checks on the cadastre system before approving the issuance of a new license or renewing an existing license.	My immediate supervisor encourages me to practice on the cadastre system training site and recognizes my effort.
Amhara Region	Agree	Agree	Agree	Disagree
SNNP Region	Disagree	Disagree	Disagree	Disagree
Oromia Region	Neutral	Agree	Neutral	Neutral
Amhara Region	Neutral	Disagree	Neutral	Disagree
Oromia Region	Disagree	Disagree	Neutral	Neutral
Oromia Region	Disagree	Disagree	Disagree	Disagree
Dire Dawa City Administration	Agree	Agree	Agree	Neutral
Oromia Region	Agree	Agree	Neutral	Agree
Dire Dawa City Administration	Strongly Disagree	Disagree	Neutral	Strongly Disagree
SNNP Region	Disagree	Disagree	Disagree	Disagree
Oromia Region	Disagree	Disagree	Neutral	Disagree
SNNP Region	Agree	Agree	Neutral	Neutral
Amhara Region	Neutral	Disagree	Neutral	Disagree
Amhara Region	Disagree	Disagree	Disagree	Disagree
SNNP Region	Disagree	Neutral	Neutral	Neutral
Dire Dawa City Administration	Disagree	Disagree	Disagree	Disagree
Harari Region	Strongly Disagree	Strongly Disagree	Neutral	Neutral
SNNP Region	Agree	Agree	Agree	Agree
SNNP Region	Strongly Disagree	Strongly Disagree	Disagree	Strongly Disagree
SNNP Region	Neutral	Disagree	Disagree	Disagree
Harari Region	Neutral	Disagree	Neutral	Neutral
Somali Region	Strongly Disagree	Strongly Disagree	Disagree	Strongly Disagree
Dire Dawa City Administration	Disagree	Strongly Disagree	Neutral	Neutral
Harari Region	Disagree	Disagree	Disagree	Disagree
Afar Region	Disagree	Disagree	Neutral	Neutral
Afar Region	Disagree	Disagree	Neutral	Disagree
Afar Region	Strongly Disagree	Strongly Disagree	Disagree	Strongly Disagree
Somali Region	Disagree	Strongly Disagree	Neutral	Disagree
Somali Region	Disagree	Disagree	Neutral	Neutral
Benishangul Region	Strongly Disagree	Strongly Disagree	Disagree	Strongly Disagree

Directorate/Section/Region	My immediate supervisor allows me the time to attend cadastre system related training sessions.	My immediate supervisor discusses with me about how the cadastre system impacts my work processes or tasks.	My immediate supervisor checks on the cadastre system before approving the issuance of a new license or renewing an existing license.	My immediate supervisor encourages me to practice on the cadastre system training site and recognizes my effort.
Gamble Region	Disagree	Disagree	Neutral	Disagree
Benishangul Region	Strongly Disagree	Strongly Disagree	Strongly Disagree	Strongly Disagree
Addis Ababa City Administration	Neutral	Disagree	Neutral	Disagree
Addis Ababa City Administration	Neutral	Disagree	Neutral	Disagree
Gamble Region	Disagree	Disagree	Disagree	Disagree
Benishangul Region	Strongly Disagree	Strongly Disagree	Neutral	Strongly Disagree
Addis Ababa City Administration	Disagree	Disagree	Neutral	Strongly Disagree
Benishangul Region	Neutral	Neutral	Neutral	Disagree
M01	Strongly Disagree	Disagree	Neutral	Strongly Disagree
M02	Agree	Agree	Neutral	Neutral
M03	Strongly Disagree	Disagree	Neutral	Strongly Disagree
M04	Agree	Agree	Agree	Agree
M05	Agree	Disagree	Neutral	Disagree
M06	Agree	Agree	Agree	Agree
M07	Neutral	Disagree	Neutral	Disagree
M08	Agree	Neutral	Neutral	Neutral
M09	Strongly Agree	Agree	Agree	Agree
M10	Strongly Disagree	Strongly Disagree	Strongly Disagree	Strongly Disagree
M11	Agree	Agree	Neutral	Agree
M12	Agree	Agree	Agree	Agree
M13	Strongly Agree	Agree	Agree	Agree
M14	Agree	Disagree	Neutral	Neutral
M15	Agree	Disagree	Agree	Agree
M16	Disagree	Disagree	Neutral	Disagree
M17	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
M18	Agree	Agree	Agree	Agree
M19	Disagree	Disagree	Neutral	Neutral
M20	Agree	Disagree	Neutral	Disagree
M21	Neutral	Disagree	Disagree	Disagree
M22	Strongly Agree	Strongly Agree	Agree	Agree
M23	Agree	Agree	Agree	Agree
M24	Neutral	Disagree	Disagree	Disagree

Directorate/Section/Region	My immediate supervisor allows me the time to attend cadastre system related training sessions.	My immediate supervisor discusses with me about how the cadastre system impacts my work processes or tasks.	My immediate supervisor checks on the cadastre system before approving the issuance of a new license or renewing an existing license.	My immediate supervisor encourages me to practice on the cadastre system training site and recognizes my effort.
M25	Disagree	Disagree	Disagree	Disagree
M26	Disagree	Disagree	Neutral	Disagree
M27	Neutral	Neutral	Neutral	Disagree
M28	Agree	Agree	Agree	Agree
M30	Agree	Agree	Neutral	Disagree
M31	Strongly Agree	Strongly Agree	Agree	Agree

Appendix F: Training Construct of Organizational Theme Survey Response

Directorate/Section/Region	The kind of training provided to me was comprehensive enough for me to start using the cadastre system.	My level of understanding about the cadastre substantially improved after going through the cadastre training.	The training gave me confidence to start using the cadastre system	The trainers were knowledgeable and helped me in my understanding of the cadastre system.
Amhara Region	Agree	Agree	Agree	Agree
SNNP Region	Neutral	Neutral	Agree	Agree
Oromia Region	Neutral	Neutral	Neutral	Neutral
Amhara Region	Agree	Agree	Agree	Agree
Oromia Region	Neutral	Neutral	Agree	Neutral
Oromia Region	Neutral	Neutral	Disagree	Neutral
Dire Dawa City Administration	Agree	Strongly Agree	Agree	Agree
Oromia Region	Agree	Agree	Agree	Agree
Dire Dawa City Administration	Disagree	Disagree	Neutral	Neutral
SNNP Region	Neutral	Neutral	Agree	Agree
Oromia Region	Agree	Agree	Agree	Agree
SNNP Region	Agree	Strongly Agree	Agree	Agree
Amhara Region	Agree	Agree	Agree	Agree
Amhara Region	Neutral	Neutral	Agree	Neutral
SNNP Region	Neutral	Neutral	Neutral	Neutral
Dire Dawa City Administration	Neutral	Neutral	Agree	Agree
Harari Region	Neutral	Neutral	Agree	Agree
SNNP Region	Agree	Strongly Agree	Agree	Agree
SNNP Region	Disagree	Disagree	Neutral	Neutral
SNNP Region	Agree	Agree	Agree	Agree
Harari Region	Neutral	Neutral	Neutral	Neutral
Somali Region	Disagree	Disagree	Neutral	Neutral
Dire Dawa City Administration	Neutral	Neutral	Agree	Agree
Harari Region	Disagree	Disagree	Disagree	Neutral
Afar Region	Neutral	Neutral	Neutral	Neutral
Afar Region	Agree	Agree	Agree	Agree
Afar Region	Disagree	Disagree	Neutral	Neutral
Somali Region	Agree	Strongly Agree	Agree	Agree
Somali Region	Neutral	Agree	Neutral	Agree
Benishangul Region	Disagree	Disagree	Neutral	Neutral
Gamble Region	Agree	Agree	Neutral	Agree
Benishangul Region	Disagree	Disagree	Disagree	Disagree
Addis Ababa City Administration	Agree	Strongly Agree	Agree	Agree
Addis Ababa City Administration	Agree	Agree	Agree	Agree
Gamble Region	Disagree	Disagree	Disagree	Disagree

Directorate/Section/Region	The kind of training provided to me was comprehensive enough for me to start using the cadastre system.	My level of understanding about the cadastre substantially improved after going through the cadastre training.	The training gave me confidence to start using the cadastre system	The trainers were knowledgeable and helped me in my understanding of the cadastre system.
Benishangul Region	Disagree	Disagree	Disagree	Disagree
Addis Ababa City Administration	Agree	Agree	Neutral	Agree
Benishangul Region	Agree	Agree	Agree	Agree
M01	Disagree	Disagree	Neutral	Neutral
M02	Neutral	Neutral	Neutral	Neutral
M03	Disagree	Disagree	Neutral	Neutral
M04	Agree	Agree	Agree	Agree
M05	Agree	Strongly Agree	Agree	Agree
M06	Agree	Strongly Agree	Agree	Agree
M07	Agree	Strongly Agree	Agree	Agree
M08	Neutral	Neutral	Neutral	Neutral
M09	Agree	Agree	Agree	Agree
M10	Disagree	Disagree	Neutral	Neutral
M11	Agree	Strongly Agree	Agree	Agree
M12	Agree	Agree	Agree	Agree
M13	Agree	Agree	Agree	Strongly Agree
M14	Neutral	Neutral	Neutral	Neutral
M15	Agree	Strongly Agree	Agree	Agree
M16	Agree	Strongly Agree	Agree	Agree
M17	Agree	Agree	Agree	Agree
M18	Agree	Strongly Agree	Agree	Agree
M19	Agree	Agree	Agree	Agree
M20	Agree	Agree	Agree	Agree
M21	Agree	Strongly Agree	Agree	Agree
M22	Agree	Agree	Agree	Strongly Agree
M23	Agree	Strongly Agree	Agree	Agree
M24	Neutral	Agree	Agree	Agree
M25	Disagree	Disagree	Disagree	Disagree
M26	Disagree	Disagree	Disagree	Disagree
M27	Agree	Strongly Agree	Agree	Agree
M28	Strongly Agree	Strongly Agree	Agree	Agree
M30	Agree	Agree	Agree	Agree
M31	Agree	Agree	Agree	Agree

Appendix G: Communication Construct of Organizational Theme Survey Response

Directorate/Section/Region	I was well informed about upgrades, unavailability and changes in the cadastre system through email.	I was well informed about upgrades and changes in the cadastre system through my immediate supervisor or Ministry of mines focal persons.	I was well informed about upgrades and changes in the cadastre system through workshops or presentations.
Amhara Region	Disagree	Strongly Disagree	Disagree
SNNP Region	Disagree	Disagree	Neutral
Oromia Region	Disagree	Disagree	Disagree
Amhara Region	Disagree	Disagree	Agree
Oromia Region	Strongly Disagree	Strongly Disagree	Disagree
Oromia Region	Strongly Disagree	Strongly Disagree	Disagree
Dire Dawa City Administration	Disagree	Disagree	Neutral
Oromia Region	Disagree	Disagree	Disagree
Dire Dawa City Administration	Strongly Disagree	Strongly Disagree	Disagree
SNNP Region	Disagree	Disagree	Neutral
Oromia Region	Disagree	Disagree	Agree
SNNP Region	Disagree	Disagree	Neutral
Amhara Region	Strongly Disagree	Disagree	Neutral
Amhara Region	Strongly Disagree	Strongly Disagree	Disagree
SNNP Region	Disagree	Disagree	Disagree
Dire Dawa City Administration	Disagree	Disagree	Neutral
Harari Region	Strongly Disagree	Strongly Disagree	Disagree
SNNP Region	Disagree	Disagree	Disagree
SNNP Region	Strongly Disagree	Strongly Disagree	Disagree
SNNP Region	Strongly Disagree	Disagree	Neutral
Harari Region	Disagree	Disagree	Disagree
Somali Region	Strongly Disagree	Strongly Disagree	Disagree
Dire Dawa City Administration	Strongly Disagree	Disagree	Disagree
Harari Region	Strongly Disagree	Strongly Disagree	Disagree
Afar Region	Disagree	Disagree	Disagree
Afar Region	Strongly Disagree	Disagree	Disagree
Afar Region	Disagree	Disagree	Neutral
Somali Region	Strongly Disagree	Disagree	Neutral
Somali Region	Disagree	Disagree	Disagree
Benishangul Region	Strongly Disagree	Strongly Disagree	Disagree
Gamble Region	Disagree	Disagree	Disagree
Benishangul Region	Strongly Disagree	Strongly Disagree	Neutral
Addis Ababa City Administration	Strongly Disagree	Disagree	Disagree
Addis Ababa City Administration	Strongly Disagree	Disagree	Neutral
Gamble Region	Strongly Disagree	Strongly Disagree	Disagree
Benishangul Region	Strongly Disagree	Strongly Disagree	Neutral
Addis Ababa City Administration	Disagree	Disagree	Disagree
Benishangul Region	Strongly Disagree	Disagree	Disagree
M01	Disagree	Strongly Disagree	Disagree

Directorate/Section/Region	I was well informed about upgrades, unavailability and changes in the cadastre system through email.	I was well informed about upgrades and changes in the cadastre system through my immediate supervisor or Ministry of mines focal persons.	I was well informed about upgrades and changes in the cadastre system through workshops or presentations.
M02	Strongly Disagree	Strongly Disagree	Disagree
M03	Strongly Disagree	Strongly Disagree	Disagree
M04	Disagree	Disagree	Neutral
M05	Disagree	Disagree	Disagree
M06	Disagree	Disagree	Disagree
M07	Strongly Disagree	Strongly Disagree	Disagree
M08	Disagree	Disagree	Neutral
M09	Disagree	Disagree	Neutral
M10	Strongly Disagree	Disagree	Neutral
M11	Strongly Disagree	Strongly Disagree	Disagree
M12	Disagree	Disagree	Disagree
M13	Strongly Disagree	Disagree	Disagree
M14	Strongly Disagree	Disagree	Disagree
M15	Agree	Neutral	Disagree
M16	Strongly Disagree	Disagree	Disagree
M17	Strongly Disagree	Agree	Agree
M18	Strongly Disagree	Disagree	Disagree
M19	Disagree	Disagree	Disagree
M20	Strongly Disagree	Strongly Disagree	Disagree
M21	Strongly Disagree	Disagree	Disagree
M22	Agree	Agree	Neutral
M23	Agree	Neutral	Neutral
M24	Strongly Disagree	Strongly Disagree	Disagree
M25	Strongly Disagree	Strongly Disagree	Disagree
M26	Strongly Disagree	Strongly Disagree	Disagree
M27	Strongly Disagree	Disagree	Disagree
M28	Agree	Agree	Neutral
M30	Strongly Disagree	Strongly Disagree	Disagree
M31	Strongly Disagree	Disagree	Disagree

Appendix H: Training Manual Construct of Organizational Theme Survey Response

Directorate/Section/Region	The content and index of the cadastre user manual are useful.	The cadastre user manual is current and up to date.	The cadastre user manual is complete.
Amhara Region	Agree	Agree	Agree
SNNP Region	Agree	Agree	Neutral
Oromia Region	Neutral	Agree	Neutral
Amhara Region	Strongly Agree	Strongly Agree	Agree
Oromia Region	Neutral	Agree	Neutral
Oromia Region	Neutral	Neutral	Neutral
Dire Dawa City Administration	Agree	Agree	Neutral
Oromia Region	Agree	Agree	Neutral
Dire Dawa City Administration	Neutral	Neutral	Neutral
SNNP Region	Agree	Agree	Neutral
Oromia Region	Agree	Agree	Agree
SNNP Region	Agree	Agree	Neutral
Amhara Region	Agree	Strongly Agree	Agree
Amhara Region	Neutral	Neutral	Neutral
SNNP Region	Neutral	Agree	Neutral
Dire Dawa City Administration	Neutral	Agree	Neutral
Harari Region	Neutral	Agree	Neutral
SNNP Region	Agree	Agree	Neutral
SNNP Region	Neutral	Neutral	Neutral
SNNP Region	Neutral	Agree	Neutral
Harari Region	Agree	Agree	Neutral
Somali Region	Neutral	Neutral	Neutral
Dire Dawa City Administration	Agree	Agree	Neutral
Harari Region	Neutral	Neutral	Neutral
Afar Region	Neutral	Agree	Neutral
Afar Region	Agree	Strongly Agree	Agree
Afar Region	Agree	Agree	Agree
Somali Region	Neutral	Agree	Neutral
Somali Region	Neutral	Agree	Neutral
Benishangul Region	Neutral	Neutral	Neutral
Gamble Region	Neutral	Agree	Neutral
Benishangul Region	Neutral	Neutral	Neutral
Addis Ababa City Administration	Neutral	Agree	Neutral
Addis Ababa City Administration	Neutral	Agree	Neutral
Gamble Region	Neutral	Neutral	Neutral
Benishangul Region	Neutral	Neutral	Neutral
Addis Ababa City Administration	Neutral	Agree	Neutral
Benishangul Region	Neutral	Agree	Neutral
M01	Agree	Agree	Agree
M02	Neutral	Agree	Neutral
M03	Agree	Agree	Neutral

Directorate/Section/Region	The content and index of the cadastre user manual are useful.	The cadastre user manual is current and up to date.	The cadastre user manual is complete.
M04	Agree	Agree	Agree
M05	Agree	Agree	Neutral
M06	Agree	Agree	Agree
M07	Neutral	Agree	Neutral
M08	Neutral	Neutral	Neutral
M09	Agree	Agree	Agree
M10	Neutral	Neutral	Neutral
M11	Agree	Agree	Agree
M12	Agree	Agree	Neutral
M13	Agree	Agree	Agree
M14	Neutral	Neutral	Neutral
M15	Agree	Agree	Agree
M16	Neutral	Agree	Neutral
M17	Agree	Agree	Agree
M18	Agree	Agree	Neutral
M19	Neutral	Agree	Neutral
M20	Agree	Agree	Neutral
M21	Neutral	Agree	Neutral
M22	Agree	Agree	Agree
M23	Agree	Agree	Neutral
M24	Neutral	Agree	Neutral
M25	Disagree	Neutral	Disagree
M26	Neutral	Neutral	Neutral
M27	Neutral	Agree	Neutral
M28	Agree	Agree	Neutral
M30	Agree	Agree	Neutral
M31	Agree	Agree	Agree

Appendix I: Data Quality Improvement Construct of the Operational Theme Survey Response

Directorate/Section/Region	The data output from the cadastre system is appropriate and complete.	Incorrect data input can be instantly discovered by the cadaster system.	The cadastre system users understand the concept and the value of integrated data for issuing and administering mineral rights licenses.	Data accuracy and integrity has been improved by using the cadastre system.
Amhara Region	Agree	Agree	Agree	Agree
SNNP Region	Agree	Agree	Neutral	Agree
Oromia Region	Neutral	Neutral	Neutral	Neutral
Amhara Region	Agree	Neutral	Neutral	Agree
Oromia Region	Neutral	Neutral	Neutral	Neutral
Oromia Region	Neutral	Neutral	Disagree	Neutral
Dire Dawa City Administration	Agree	Neutral	Neutral	Agree
Oromia Region	Agree	Agree	Neutral	Agree
Dire Dawa City Administration	Neutral	Neutral	Disagree	Neutral
SNNP Region	Agree	Agree	Neutral	Agree
Oromia Region	Strongly Agree	Neutral	Neutral	Agree
SNNP Region	Agree	Agree	Agree	Agree
Amhara Region	Strongly Agree	Strongly Agree	Neutral	Agree
Amhara Region	Agree	Agree	Neutral	Agree
SNNP Region	Neutral	Neutral	Neutral	Neutral
Dire Dawa City Administration	Agree	Agree	Neutral	Neutral
Harari Region	Agree	Neutral	Neutral	Neutral
SNNP Region	Agree	Agree	Agree	Agree
SNNP Region	Neutral	Neutral	Neutral	Neutral
SNNP Region	Agree	Agree	Disagree	Neutral
Harari Region	Neutral	Neutral	Disagree	Neutral
Somali Region	Neutral	Neutral	Neutral	Neutral
Dire Dawa City Administration	Agree	Agree	Neutral	Neutral
Harari Region	Disagree	Disagree	Disagree	Disagree
Afar Region	Neutral	Neutral	Neutral	Neutral
Afar Region	Agree	Agree	Neutral	Disagree
Afar Region	Neutral	Neutral	Disagree	Neutral
Somali Region	Neutral	Neutral	Neutral	Neutral
Somali Region	Neutral	Neutral	Disagree	Disagree
Benishangul Region	Disagree	Neutral	Disagree	Neutral
Gamble Region	Agree	Neutral	Neutral	Neutral
Benishangul Region	Disagree	Disagree	Disagree	Disagree
Addis Ababa City Administration	Agree	Agree	Agree	Agree
Addis Ababa City Administration	Agree	Agree	Neutral	Neutral
Gamble Region	Neutral	Neutral	Neutral	Neutral

Directorate/Section/Region	The data output from the cadastre system is appropriate and complete.	Incorrect data input can be instantly discovered by the cadaster system.	The cadastre system users understand the concept and the value of integrated data for issuing and administering mineral rights licenses.	Data accuracy and integrity has been improved by using the cadastre system.
Benishangul Region	Neutral	Neutral	Disagree	Disagree
Addis Ababa City Administration	Neutral	Neutral	Neutral	Neutral
Benishangul Region	Neutral	Neutral	Neutral	Neutral
M01	Strongly Agree	Agree	Neutral	Agree
M02	Agree	Agree	Agree	Agree
M03	Neutral	Neutral	Neutral	Neutral
M04	Strongly Agree	Strongly Agree	Agree	Agree
M05	Agree	Agree	Neutral	Neutral
M06	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
M07	Agree	Agree	Disagree	Neutral
M08	Agree	Agree	Agree	Agree
M09	Strongly Agree	Strongly Agree	Neutral	Agree
M10	Neutral	Neutral	Neutral	Neutral
M11	Strongly Agree	Strongly Agree	Neutral	Agree
M12	Agree	Agree	Agree	Agree
M13	Strongly Agree	Strongly Agree	Agree	Agree
M14	Agree	Agree	Agree	Agree
M15	Agree	Agree	Agree	Agree
M16	Strongly Agree	Strongly Agree	Agree	Agree
M17	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
M18	Agree	Agree	Neutral	Agree
M19	Agree	Agree	Neutral	Neutral
M20	Neutral	Neutral	Disagree	Neutral
M21	Agree	Agree	Agree	Agree
M22	Strongly Agree	Strongly Agree	Agree	Strongly Agree
M23	Agree	Agree	Disagree	Neutral
M24	Agree	Agree	Disagree	Neutral
M25	Neutral	Neutral	Neutral	Neutral
M26	Disagree	Disagree	Disagree	Disagree
M27	Agree	Agree	Neutral	Neutral
M28	Agree	Agree	Agree	Agree
M30	Agree	Neutral	Neutral	Neutral

Directorate/Section/Region	The data output from the cadastre system is appropriate and complete.	Incorrect data input can be instantly discovered by the cadaster system.	The cadastre system users understand the concept and the value of integrated data for issuing and administering mineral rights licenses.	Data accuracy and integrity has been improved by using the cadastre system.
M31	Strongly Agree	Agree	Neutral	Agree

Appendix J: ENMCS Perceived Usefulness and Overall Satisfaction Survey Response

Directorate/Section/Region	Using the cadastre system will make my work more efficient	Using the cadastre system will increase my job performance.	Using the cadastre system will increase the productivity of my work.	Using the cadastre system will enable me to increase the efficiency of my decision-making	Overall I am satisfied with the cadastre system
Amhara Region	Agree	Agree	Agree	Strongly Disagree	Strongly Agree
SNNP Region	Agree	Agree	Neutral	Agree	Agree
Oromia Region	Neutral	Neutral	Neutral	Neutral	Neutral
Amhara Region	Agree	Agree	Agree	Strongly Agree	Agree
Oromia Region	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
Oromia Region	Neutral	Neutral	Neutral	Disagree	Disagree
Dire Dawa City Administration	Agree	Agree	Agree	Strongly Agree	Agree
Oromia Region	Agree	Agree	Agree	Neutral	Agree
Dire Dawa City Administration	Disagree	Disagree	Disagree	Disagree	Disagree
SNNP Region	Agree	Agree	Neutral	Agree	Agree
Oromia Region	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree
SNNP Region	Agree	Agree	Agree	Agree	Agree
Amhara Region	Agree	Agree	Agree	Strongly Agree	Strongly Agree
Amhara Region	Neutral	Neutral	Neutral	Neutral	Neutral
SNNP Region	Neutral	Neutral	Neutral	Disagree	Neutral
Dire Dawa City Administration	Neutral	Neutral	Neutral	Neutral	Neutral
Harari Region	Disagree	Disagree	Disagree	Strongly Disagree	Disagree
SNNP Region	Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
SNNP Region	Neutral	Neutral	Neutral	Neutral	Neutral
SNNP Region	Agree	Agree	Agree	Strongly Agree	Agree
Harari Region	Neutral	Neutral	Neutral	Neutral	Neutral
Somali Region	Neutral	Neutral	Neutral	Disagree	Neutral
Dire Dawa City Administration	Agree	Agree	Agree	Agree	Agree
Harari Region	Disagree	Disagree	Disagree	Strongly Disagree	Disagree

Directorate/Section/Region	Using the cadastre system will make my work more efficient	Using the cadastre system will increase my job performance.	Using the cadastre system will increase the productivity of my work.	Using the cadastre system will enable me to increase the efficiency of my decision-making	Overall I am satisfied with the cadastre system
Afar Region	Neutral	Neutral	Neutral	Disagree	Disagree
Afar Region	Agree	Agree	Agree	Agree	Strongly Agree
Afar Region	Neutral	Neutral	Neutral	Neutral	Neutral
Somali Region	Agree	Agree	Agree	Strongly Agree	Agree
Somali Region	Neutral	Neutral	Neutral	Disagree	Neutral
Benishangul Region	Disagree	Disagree	Disagree	Strongly Disagree	Disagree
Gamble Region	Agree	Agree	Agree	Agree	Agree
Benishangul Region	Strongly Disagree	Strongly Disagree	Strongly Disagree	Strongly Disagree	Strongly Disagree
Addis Ababa City Administration	Agree	Agree	Agree	Agree	Agree
Addis Ababa City Administration	Agree	Agree	Agree	Agree	Agree
Gamble Region	Disagree	Disagree	Disagree	Disagree	Disagree
Benishangul Region	Neutral	Neutral	Neutral	Disagree	Neutral
Addis Ababa City Administration	Agree	Agree	Agree	Agree	Agree
Benishangul Region	Neutral	Agree	Agree	Neutral	Agree
M01	Neutral	Neutral	Neutral	Neutral	Neutral
M02	Neutral	Neutral	Neutral	Disagree	Neutral
M03	Agree	Agree	Agree	Agree	Agree
M04	Agree	Agree	Agree	Agree	Agree
M05	Agree	Strongly Agree	Agree	Agree	Agree
M06	Agree	Agree	Agree	Agree	Agree
M07	Agree	Agree	Agree	Strongly Agree	Strongly Agree
M08	Neutral	Neutral	Neutral	Neutral	Agree
M09	Agree	Agree	Agree	Strongly Agree	Agree
M10	Neutral	Neutral	Neutral	Disagree	Neutral

Directorate/Section/Region	Using the cadastre system will make my work more efficient	Using the cadastre system will increase my job performance.	Using the cadastre system will increase the productivity of my work.	Using the cadastre system will enable me to increase the efficiency of my decision-making	Overall I am satisfied with the cadastre system
M11	Agree	Agree	Agree	Agree	Agree
M12	Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
M13	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
M14	Neutral	Neutral	Neutral	Neutral	Neutral
M15	Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
M16	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
M17	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
M18	Agree	Strongly Agree	Agree	Agree	Agree
M19	Agree	Strongly Agree	Agree	Agree	Agree
M20	Agree	Neutral	Agree	Neutral	Agree
M21	Agree	Agree	Agree	Agree	Agree
M22	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
M23	Agree	Agree	Agree	Agree	Agree
M24	Neutral	Neutral	Neutral	Neutral	Agree
M25	Disagree	Disagree	Disagree	Disagree	Neutral
M26	Disagree	Disagree	Disagree	Strongly Disagree	Disagree
M27	Agree	Agree	Agree	Neutral	Agree
M28	Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
M30	Agree	Agree	Agree	Agree	Agree
M31	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree

