

**DESIGNING WEB BASED INFORMATION ARCHITECTURE  
FOR INFORMATION SHARING AND INTEGRATION: THE  
CASE OF ETHIOPIAN LEATHER INDUSTRY  
DEVELOPMENT INSTITUTE**

**By**

**ANTENEH NIGATU**

**A Thesis Submitted to the Department of information science in  
Partial Fulfillment of the Requirements for the Degree of Master of  
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**Addis Ababa University  
School of Graduate Studies,  
College of Science  
Department of Information Science**

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**Name and signature of Members of the Examining Board**

Chairperson: \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

Advisor: \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

Examiner: \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

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Chair of Department or Graduate Program Coordinator

## **Dedicated To**

I would like to dedicate this paper to my Strong mother who has been struggling and fighting for my education since I was a little boy and for my beloved Wife.

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## **DECLARATION**

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

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Date

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

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Advisor

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## LIST OF ACRONYMS

<b>ADM</b> .....	Architecture Development Method
<b>BPM</b> .....	Business Process Management
<b>CIO</b> .....	Chief Information Officer
<b>COMESA</b> .....	Common Market for Eastern and Southern Africa
<b>DM</b> .....	Document Management
<b>DSR</b> .....	Design Science Research
<b>EA</b> .....	Enterprise Architecture
<b>ECM</b> .....	Enterprise Content Management
<b>EIA</b> .....	Enterprise Information Architecture
<b>ELIDI</b> .....	Ethiopian Leather Industry Development Institute
<b>ERM</b> .....	Electronic Records Management
<b>FPD</b> .....	Finance & Procurement Directorate
<b>FTD</b> .....	Footwear Technology Directorate
<b>GTD</b> .....	Goods and Garment Technology Directorate
<b>IA</b> .....	Information Architecture
<b>ICT</b> .....	Information Communication Technology
<b>IPD</b> .....	Information, Planning and Monitoring Directorate
<b>KM</b> .....	Knowledge Management
<b>KMD</b> .....	Knowledge & Marketing Directorate
<b>KMU</b> .....	Knowledge Marketing Unit
<b>LIDI</b> .....	Leather Industry Development Institute
<b>LLPTI</b> .....	Leather & Leather Products Technology Institute
<b>LTD</b> .....	Leather Technology Directorate
<b>MDM</b> .....	Master Data Management
<b>OMG</b> .....	Object Management Group
<b>PDU</b> .....	Product Development Unit
<b>PFU</b> .....	Pilot Footwear Unit
<b>PGU</b> .....	Pilots Goods and Garment Unit
<b>PTU</b> .....	Pilot Tannery Unit
<b>TAFIM</b> .....	Technical Architecture Framework for Information Management
<b>TOGAF</b> .....	The Open Group Architectural Framework
<b>UML</b> .....	Unified Modeling Language
<b>WCM</b> .....	Web Content Management

## ABSTRACT

Information sharing is a key prerequisite and an essential activity in all collaborative work, and helps to bind groups and communities together. In the current information-driven and technology based global economy, organizations are becoming increasingly dependent on the cumulative knowledge of their employees, suppliers, customers, and other key stakeholders. This research is conducted at Ethiopian Leather Industry Development Institute (ELIDI).

The main objective of this research is to design web based Information Architecture (IA) to promote information sharing among the employees of ELIDI and with the leather industries. The study attempted to answer the basic questions of what the key information sharing practices in ELIDI are, what leather and leather product-information contents are required in ELIDI's IA according to ELIDI's line directorates' requirement and how a suitable IA can be designed for ELIDI.

The study was conducted using design science research and case study. TOGAF was also used as a tool to identify actors in the Web based IA. The data collection was done through interview and personal observation for qualitative survey. Key informants were selected from the Directorates that are involved in the leather and leather product development on the basis of TOGAF. Secondary data were also collected during the field work.

The challenges and practices identified during the research were mainly the absence of standardized central database at ELIDI which forced the directorate to work in isolation, to collect and share information only through traditional methods like emails, faxes and personal contact. The absence of centralized database was confirmed by the interview and personal observation. This has tremendously affected the data quality, security, accuracy, consistency, and completeness. This calls for the design of a Web Based Information Architecture which is used as a platform to share and exchange information among the directorates of ELIDI and the leather industry players.

Therefore, this research attempts to design a Web Based Information Architecture. The architecture has covered all the information required regarding leather and leather products. The architecture is believed to create a better way of information sharing mechanisms that will contribute to the sustainable growth of the leather sector. The prototype was evaluated by experts from ELIDI. The evaluation result showed that 87.5% of the experts believe that the web based IA is useful.

**Key words:** *information sharing, information architecture, Web Based Information Architecture, Ethiopian Leather Industry Development Institute, design science research, TOGAF.*

# CHAPTER ONE: INTRODUCTION

## 1.1 Background

In the current information-driven and technologically based global economy, organizations are becoming increasingly dependent on the cumulative knowledge of their employees, suppliers, customers, and other key stakeholders. Information is data that have been analyzed and/or contextualized, carries a message and makes a difference as perceived by the receiver [1]. It can be defined as data that is communicated, has meaning, has an effect, and has a goal [2]. Information is important for the development and competitiveness of leather industries in Ethiopia. However, having information by itself is not worthy unless it is shared with potential users [3]. Thus, organizations continue to improve their information management practice due to the need for improving the efficiency of business processes and the demands to deliver new services [4].

Ethiopian Leather Industry Development Institute (ELIDI) is an autonomous Federal Government Office having its own legal personality. The major objectives of ELIDI are facilitating the development and the transfer of leather and leather product industries technologies and enabling the industries to become competitive and beget rapid development [5]. In order to meet these objectives, the institute has different powers and duties. Some of the powers and duties are the following : formulate policies, strategies and programs that assist in the facilitation of the development of leather and leather products industries; and implement the same upon approval; collect, analyze, organize and transfer to the sector's data center and disseminate to users, as may be appropriate, data necessary for the development of leather and leather products industries; prepare and disseminate project profiles that may be helpful in expanding investments in the leather and leather products industries; conduct joint research and assist in the strengthening of local research capacity in the sector, deliver its services to users at one stop shop, conduct market study for leather industries etc...These activities and the business processes that support them depend centrally on the use, creation, sharing and exchange of information. All these activities and the business processes done by ELIDI are meant to support the development of leather industries. In an effort to turn this growth pattern and the vision of the government for the manufacturing sector into a reality, the government established ELIDI [5].

The interview and personal observation disclosed that there is no centralized database at ELIDI. The directorates collect information in bits and pieces from different resources. The required information is owned by different members in the supply chain process and stored in different

applications which lack integration into a single view. This creates information gap with in sections of the directorates as well as with other directorates.

Therefore, a centralized database to store all the information of the leather and leather products is highly needed to increase the information sharing of stakeholders and the development of the leather sector. To this end, IA is used to build a repository which is a platform to share and exchange information among the directorates of ELIDI and the leather industry players.

In the public sector, information sharing is defined as exchanging or otherwise giving other agencies access to information [6]. Information sharing is an essential activity in all collaborative work, and helps to bind groups and communities together [7]. Sharing and integrating information across government with private organizations has become more attractive and practical as well [8]. As a result, many developed and developing countries with the development of information and communication technology, inter organizational networks and external alliances have become more common [9].

IA is an emerging new discipline that focuses specifically on organizing, structuring, and labeling content in an effective and sustainable way [10]. Its goal is to help users find information and complete tasks [10]. IA involves the design of organization and navigation systems that support usability and find ability. It is broadly defined as a model or the practice of building the model for an information space or a set of information that is organized and managed together [11]. The model describes the rules for how that information should be maintained, interlinked, accessed and presented [11]. As IA is new, the tools, methods, models, frameworks are still in the grey area in the IT world. Similarly, ELIDI has no standardized information sharing methods. Its different directorates work in isolation and collaborate only through traditional methods. Now, more than ever, ELIDI needs information architecture to describe the information assets it manages that need to be formulated from an enterprise perspective to ensure ongoing and emerging efforts are synchronized in a holistic, complementary fashion.

Hence, the purpose of this research is to design Web Based Information Architecture in the context of ELIDI where it can be used towards development of integrated repository. The main role of this research is to model the basic structure of information architecture that can meet the requirements needed by ELIDI so that they could easily search, refer, exchange, share, update or insert new information about leather and leather products.

## **1.2. Statement of the Problem**

Information is essential in the modern business world and hence information management is a determining factor for the survival of almost all businesses. Information sharing is a key ingredient for organizations seeking to remain competitive [12]. It is also an essential activity in all collaborative work, and helps to bind groups, organizations and communities together [7]. Organizations that encourage information sharing have been found to gain competitive advantage in the long term [13]. Though limited information sharing across an organization is most likely to result in information gaps, the understanding and practice of information sharing is becoming increasingly essential for organizations to stay competitive and boost profitability [14].

Even though the importance of information sharing is undeniable, sharing and integrating large amounts of data with different forms, from different organisations with different geographical locations and different technological platforms also poses numerous challenges regarding other technical factors such as data quality, security, accuracy, consistency, and completeness [15]. Lack of interoperability standards and disparities in architecture are also noticeable concerns in information sharing [16].

A previous research conducted on the Performance of the Ethiopian Leather stated the following. There are a number of intricate factors explaining the weak performance of the Ethiopian leather sector in the regional market. The key element in this regard is found to be lack of adequate information and appropriate link. The large-scale information gap that prevails in the leather sector is the main cause that results in its low level of intra-COMESA export trade performance [17].

During the interview with the information and plan Directorate of ELIDI, the above facts were confirmed by explaining the absence of standard centralized databases at ELIDI with the intention to support the development of the sector. The Directorates work in isolation and collaborate through traditional methods. Information is collected through emails, phones, and faxes and in person. Due to this reason, pockets of information residing in silos, multiple sources of the same information and the leather sector industries are unable to share information easily with ELIDI and lack integration of internal applications. This leads to the weak performance of the Ethiopian leather sector in the regional market and decision makers fail to access required information at one place. Hence, quality of decisions depend on the information available at the spot and on individual experiences.

Previous literature reviews indicated that IA has been practised widely during the 90's [19]. In Ethiopia, particularly in the leather and leather products sector, IA is not implemented yet. Based

on the previous literature review, IA is found to be a useful tool to conceptualize the information elements of the leather and leather products sector so as to improve the information sharing process of ELIDI. Therefore, this research attempts to design a Web Based Information Architecture by identifying the leather and leather products-information related elements required for ELIDI and developing content for information sharing services for ELIDI and the leather and leather products sector. This will enable to create a better way of information sharing mechanisms that will contribute to the sustainable growth of the leather sector.

### **1.3. Research Questions**

In order to gain a better understanding of the stated problem, the research is guided by the following research questions:

- What are the key information sharing practices in ELIDI?
- What leather and leather product-information contents are required in ELIDI's IA according to ELIDI's line directorates' requirement?
- How can a suitable IA be designed for ELIDI?

### **1.4. Objective of the Study**

#### **1.4.1. General Objective**

The main objective of this research is to design a web based information architecture for ELIDI to promote information sharing among ELIDI employees and ELIDI with leather industries.

#### **1.4.2. Specific Objectives**

To achieve the main goals, the study has the following specific objectives:

- To identify the information sharing practices of ELIDI.
- To identify the information structure of ELIDI domain focusing on leather and leather products services.
- To design a web based information architecture for ELIDI.

### **1.5. Significance of the Study**

Information management is the organization of and control over the structure, processing and delivery of information [18]. As information is critical to the success of a business, there is an ever increasing concern about its availability and protection [18]. In order to make the right decision,

organizations need information on costs, product demand, at least from the firms' point of view, and potential moves of their competitors.

The significance of this research paper is, primarily, to initiate practitioners and other stakeholders, who have the interest, to undertake a more comprehensive investigation of the problem. Besides, as the output of this research is expected to augment a shared body of knowledge, or as it fills the information gap pertaining to the problem of information sharing as a result of implementing the IA. It could also be used by practitioners of the leather sector and policy makers of the respective agency. Similarly, the findings of the study could also be used by staff of ELIDI and the leather sector.

According to [17] some studies have been done on information sharing practices of the leather industry sector in Ethiopia, the researcher has never come across any solution proposed to address the problem. In general, the output of this research is believed to have paramount significance for the smooth implementation and proper use of IA and increasing the understanding of practitioners and managers of ELIDI to promote information sharing among their employees in particular and the leather sector in general so that the existing problems can be solved.

## **1.6. Scope and Limitation of the Study**

### **1.6.1. Scope of the Study**

This research focuses on the design of web based Information Architecture to improve the information sharing practice of ELIDI. The research discusses on how to design suitable IA for ELIDI Repository limited to the Footwear Technology, Goods and Garment Technology and Leather Technology Directorates' information assets and their relationship to the business processes and business objectives. This research tries to identify the required information, flows of information, and data interrelations of the directorates and represent the data to build a web based IA. The end product will be a web based information model for ELIDI. However, the research did not include detail Web based IA implementation activities and the remaining directorates of ELIDI as well as the leather and leather products industries.

### **1.6.2. Limitation of the Study**

This research does not cover an in -depth investigation about the infrastructure aspects related to EA. These aspects are at a lower level of abstraction and are not deterministic factors when it comes to the focus of the study's research question, which relates to the practical

implementation of the information architecture phase within EA. Another limitation is that the study does not encompass an analysis of the other phases within TOGAF's Architecture Development Method (ADM). Addressing all of the ADM's phases would mean that the study's scope would be too large for a single thesis dissertation.

## **1.7. Organization of the Thesis**

The thesis is presented in seven chapters. Chapter one discusses background of the study, problem statement, objective of the research, significance of the research, scope and limitation of the research and research questions. Chapter two is the literature review in which the issues and trends in IA and different conceptual and empirical concepts regarding Information Architecture and current information technologies available for information integration are discussed. Chapter three discusses the methodology employed along with the research design to identify the potential key requirements and to design the architecture. Furthermore, design of data collection tools, data collection, and analysis are discussed in this chapter. Chapter four describes Data analysis and results. Chapter five deals with designing ELIDI's IA. It also gives the business process model, information architecture which is one of the objectives of this research. It is based on the methodology described and the results from the previous chapter and literature review. Chapter Six Evaluation of the prototype Web based IA and Chapter seven summarizes the research findings and provides conclusions and recommendation based on the research findings.

## CHAPTER TWO: LITERATURE REVIEW

### 2.1. Introduction

This chapter reviews literature related to the research. This chapter is divided in two main sections. The first one covers the theoretical background and the second one deals with technical aspects of namely Enterprise architecture that will help for the design of web based information Architecture.

In this literature review, the concept of Information-Architecture and the necessary elements related to the information sharing process will be discussed. This helps to structure the research, and, that is why, this chapter is considered as conceptualization phase.

As the concept of IA is not unique and is very abstract, the researcher support its definition with the explanation of the broader notion of “Enterprise-Wide” and with the explanation of “Enterprise Architecture Frameworks” that support the construction of different architectures. This will be made in sections 2.3, 2.4 and 2.5. In the last section, section 2.6, the general process for constructing an IA is explained, and is linked to the case of the ELIDI. Those sections structures the problem under research, and provides a basic framework illustration on the elements that must be analyzed in subsequent chapters.

IA development process begins with a review of literature with the main purpose to:

- Gain insight into reliable resources that would help in solving the problem expressed in the current information practice.
- Find fresh perspectives into the problem and a solution, so as to know how to design web based information architecture.
- Bring up new information and ideas regarding the problem area, in order to improve the quality of the eventual solution.
- Find important sense making links to help in the interpretation of my findings and ultimately link the research to the work of other researchers.

### 2.2. Overview of Information

#### 2.2.1. What Is Information?

“Information” as cited by [20] “have, not surprisingly, occupied the thoughts of information scientists for a long time: almost certainly since the term ‘information science’ was coined in 1955.

The lay person, asked to define information, is most likely to regard it as an item of information or intelligence; a fact or circumstance of which one is told. This is just one of the many dictionary definitions of the word. Indeed, information scientists appear to have been reluctant to propose definitions of information, preferring rather to discuss concepts [20]: the difference being, according to Belkin, a definition 'says what the phenomenon defined is, whereas a concept is a way of looking at or interpreting the phenomenon'.

"Information is the collection of data, which, presented in a particular manner and at an appropriate time, improves the knowledge of the person receiving it in such a way that he/she is better able to undertake a required activity or make a required decision.[21] ". In addition [22] expand on the role of the information, detailing the form of delivery: "A message, usually in the form of a document or an audible or visible communication, meant to change the way a receiver perceives something and to influence judgement or behaviour data that makes a difference."

In other study according to [23] review and they proposed concepts of information. A summary of the concepts they consider is given below.

- **Information as a representation of knowledge**

Information is stored knowledge. Traditionally the storage medium has been books, but increasingly electronic media are becoming important.

- **Information as data in the environment**

Information can be obtained from a range of environmental stimuli and phenomena; not all of which are intended to 'convey' a message, but which can be informative when appropriately interpreted.

- **Information as part of the communication process**

Meanings are in people rather than in words or data. Timing and social factors play a significant role in the processing and interpretation of information.

- **Information as a resource or commodity**

Information is transmitted in a message from sender to receiver. The receiver interprets the message as intended by the sender. There may be added value as the information is disseminated or exchanged.

Information characteristics are these features of information that determine its use and quality.[24] Outline comprehensive taxonomy of information characteristics, referring in particular to the information requirements for each of the three levels of management control, operational,



## 2.2.2. Information Taxonomy

Understanding information taxonomy is the first step in designing better software from the ground up. Taxonomy represents the foundation upon which information architecture stands, and all well-rounded developers should have at least a basic understanding of taxonomy to ensure that they can create organized, logical applications.

**Taxonomy** – is a hierarchical or poly hierarchical listing of topics or subject categories [26]. It may not include a definition of the topics, but only the hierarchical relationship of topics to one another. A taxonomy can incorporate content from both a thesaurus and an ontology. There are no standard file formats or approaches to taxonomy construction. A taxonomy is often used to provide a structured navigational path through a content collection.

Taxonomy is essentially a type of conceptual framework. It is not a product and has no direct relationship with sales or revenue [26]. When used in the context of the Internet, taxonomy refers to the effective structuring of content within a defined scope to facilitate easy and accurate access.

Depending on the audience, the definition for taxonomy may need some adjustment. For a speech to a CIO and technical professionals [26]: Taxonomy is a conceptual framework for organizing enterprise or companywide content so our employees, partners, and customers can locate what they need easily. In other definition taxonomy is about how to organize, label, and arrange information so that we can find the information we need easily.

There are two opinion when it comes to what taxonomy really looks like. The first refers to taxonomy as a directory listing or site map. This opinion usually come from a Web development background. The second refers to taxonomy as a classification system, thesauri, and controlled vocabulary. This opinion usually come from a library and information science background. Having this opinion in both the Web development and library science communities, I would like to clarify the taxonomy puzzle by breaking it into two pieces: taxonomy structure and taxonomy view. Using the classic model-view-controller framework [26], taxonomy structure is the model and taxonomy view is the view.

### 1. Taxonomy Structure

Taxonomy structure has the following key characteristics:

- It is hierarchical. Similar to the classification systems illustrated in previously, taxonomy structure is multilevel, representing hierarchical relationships between concepts within a defined scope and context.

- It is used to categorize information. Whereas the Library of Congress classification system is used to classify publications held by a library, taxonomy structure for an organization is used to categorize enterprise wide information.
- It is an integral part of a content management system. Taxonomy structure should be made available within the content management workflow. An authorized user should be given a hierarchical listing of categories from which he or she can assign labels to content items. The assigned category should then be reviewed as part of the assessment and approval process.

## **2. Taxonomy view**

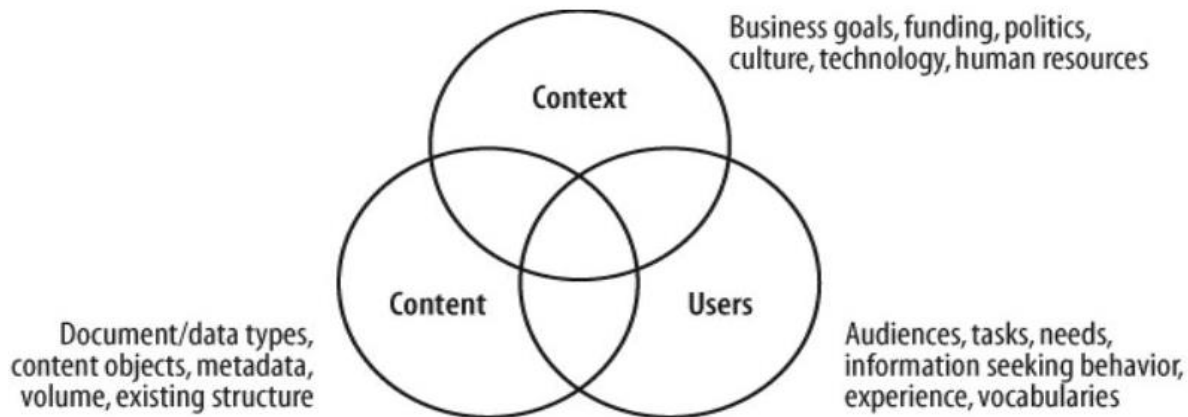
Taxonomy view is the visual aspect of taxonomy structure. It presents Web content logically by grouping information into topics so a site visitor can navigate and locate information easily.

Taxonomy view has the following key characteristics [26]:

- It may completely mirror taxonomy structure or may be completely different. Theoretically, an entire taxonomy structure can be exposed on the Web site by providing a multilevel treelike visual interface. Through such an interface, a user can drill down to each category and view a listing of content assigned to the selected category.
- It may not always be visually presented in a hierarchical format. In the View taxonomy the navigation structure is may not provide in the conventional treelike format. Rather, the multilevel navigation is achieved by using tabs as the primary navigation. This is one of the modern design formats typically seen on major Web sites.
- There can be multiple views of the same taxonomy structure. Other than model-view-controller, we may also think of taxonomy view as the visual presentation of a structure similar to database view. There may be multiple views for the same database structures. The hierarchical associations of product types on an e-commerce can be visually presented in many ways. The ultimate design pattern needs to be based on the information usage pattern of the Web site audience.
- It is an integral part of Web site design and needs to derive from analysis of the information usage patterns of the target audience. An information architect or a taxonomy expert needs to work closely with graphic artists to develop the ultimate site design. Whereas an information architect provides the conceptual navigation model for the Web site, graphic artists are responsible for applying visual treatments to the conceptual model and translating it into the final design.

### 2.2.3. Information Ecology

According to [27], it is very important to have a thorough research phase in designing an Information Architecture. When addressing how to practice Information Architecture "in the Real World" they introduce the Venn diagram Figure 2.1 [27]. With this diagram [27] tries to capture and visualize what they call the "Information Ecology".



**Figure 2.1: Information Ecology [30]**

Information Ecology is described by [28]. Davenport says that "Besides thinking holistically about an organization, there are four key attributes of information ecology: (1) integration of diverse types of information; (2) recognition of evolutionary change; (3) emphasis on observation and description; and (4) focus on people and information behavior". Other researchers [29] define an Information Ecology as "a system of people, practices, values, and technologies in a particular local environment". While wholeheartedly support the gathering of information to map out the information ecology and think of this as a key point in designing sustainable information architecture, So that the treatment of information ecology can sometimes take a philosophical turn. The research much prefer the more practical implications of the concept Information Ecology: That it is necessary to look into the surroundings and environment of the information.

According to [27] use of the term "Information Ecology" is somewhat more derived from a practical aspect than those of [28] or [29], in that they are mostly occupied with how this concept can be put to use in practicing good information architecture. However, this way of looking at Information Ecology is very useful and directly applicable in regards to actually understanding how an organization works and thereby designing a well-rounded and complete Information Architecture [27].

Now, back to the Venn diagram in Table 2.2. [27] Divides Information Ecology into three different, but overlapping categories: Content, context and users. The diagram is meant to help visualize the interconnections and overlapping areas between the three aspects. This model offers a structured approach to researching when designing IA, especially the research look at the subcategories that [27] mentions in each of the three aspects:

**Table 2.2. The subcategories of Information Ecology [27].**

Content	Context	Users
Document/data types	Business goals	Audiences
Content objects	Funding	Tasks
Metadata	Politics	Needs
Volume	Culture	Information seeking behavior
Existing structure	Technology	Experience
	Human resources	Vocabularies

## 1. Content

[27] States very plainly that content is “the stuff that makes up our site”. The very diverse content of sites is one of the things that create the need for customized information architecture [27]. In addition, [27] names a set of factors we need to take into consideration when dealing with the content of a web based information architecture: Ownership, Format, Structure, Metadata, Volume and Dynamism.

## 2. Context

The term “context” represents business goals, funding, politics, culture, technology, resources and constraints. At technical point of view, the con-text is related to things that how the information is produced or handled. In the tasks and actions point of view, the context is describing why, when and who is producing or handling the information [28]. All websites exist within a certain organizational context. Each organization has a mission, goals, strategy, staff, processes and procedures, physical and technological infrastructure, budget and culture. All of these things are unique to each organization and it is their context. This means that the IA is also unique because it must be a match to organization's context. Find out the context may be a challenging task

because all the information is not written on paper. As [27] mention in their book, much of this information is in people's head.

### **3. User**

The term 'users' refers to audience, tasks, need, information-seeking behavior and experience. It is relevant to learn users and understand their needs and information seeking behaviors. For example, the organization's manager may need to find a few documents on a specific topic but the organization's researcher may need to find all relevant documents and may spend hours on the hunt [ 27].

All this knowledge helps to recognize the types of information need and select the right content that the users need. Learning content can be made by asking users directly what they use or look for. This can be made also by looking at existing environment. In organization, for example, we can ask from staff, what one piece of information they could not live without or look popular pages. Understanding users' needs will helps us to make sure that the existing information meets the key needs, identify information gaps, make the key information easy to find and prioritize content activities [27].

#### **2.2.4. Information Management**

Information management (IM) is the collection and management of information from one or more sources and the distribution of that information to one or more audiences. This sometimes involves those who have a stake in, or a right to that information. Management means the organization of and control over the structure, processing and delivery of information [16].

AIIM agrees with this definition. Information, as we know it today, includes both electronic and physical information. The organizational structure must be capable of managing this information throughout the information lifecycle regardless of source or format (data, paper documents, electronic documents, audio, social business, video, etc.) for delivery through multiple channels that may include cell phones and web interfaces. Given these criteria, we can then say that the focus of IM is the ability of organizations to capture, manage, preserve, store and deliver the right information to the right people at the right time [16].

Information management environments are comprised of legacy information resident in line of business applications, Enterprise Content Management (ECM), Electronic Records Management (ERM), Business Process Management (BPM), Taxonomy and Metadata, Knowledge Management

(KM), Web Content Management (WCM), Document Management (DM) and Social Media Governance technology solutions and best practices [16]. Information management requires the adoption and adherence to guiding principles that include:

- Information assets are corporate assets. This principle should be acknowledged or agreed upon across the organization otherwise any business case and support for IM will be weak.
- Information must be made available and shared. Of course not all information is open to anyone, but in principle the sharing of information helps the use and exploitation of corporate knowledge.
- Information the organization needs to keep is managed and retained corporately. In other words the retention and archiving, of information. If you save a document today, you expect it to be secured and still available to you tomorrow.

Information management is a corporate responsibility that needs to be addressed and followed from the upper most senior levels of management to the front line worker. Organizations must be held and must hold its employees accountable to capture, manage, store, share, preserve and deliver information appropriately and responsibly.

### **2.3. Information Architecture**

The term architecture is not without ambiguity, even in building the construction. It can be viewed as the art and science of designing the built environment or the product of such a design. Thus, the term architecture can encompass both the blueprint for building and the general underlying principles such as its style [30]. IA term was firstly addressed by [31] in 1975 to describe the need to transform data into meaningful information, as [32] refer. Defining IA is an exercise many researchers and practitioners have performed [27,30,32,33,34,35,36,37,38,39]. [40] Noted that a widely accepted definition of IA does not exist and [32] report that no formal definition of IA has been agreed upon. As [32] states, this subject was taken into more consideration during the emergence of the World Wide Web in the 90's, when interest in information organization and structure became widespread.

Several definitions in the IA field generally focus on organizing information via mechanisms such as labeling, structuring, chunking, and categorizing in order to support navigation, findability and usefulness. [34] Definition of IA is perhaps the simplest and most straightforward: IA is the art and science of organizing information so that it is findable, manageable and useful. Some other scholar

also defines IA as a Big Architect (strategic) or Big IA and Little Architect (tactical) or Little IA [32, 35]. Thus [32] and [35] discuss these competing views. Little IA and Big IA both focus on information organization with Little IA being done from the ground up and Big IA being approached from the top down. A major difference is that of user experience. Little IA does not focus on formal user experience but more on metadata and controlled vocabulary. Big IA, as the name implies, is approached from a wider view and includes user and organizational aspects with an emphasis on information being useful, usable and acceptable.

Further definition of the IA term is given by [35], which states about the process of designing, implementing and evaluating information spaces that are humanly and socially acceptable to their intended stakeholders. This definition leads us to the IA as a discipline or a field of its own, and [35] links it more to the human activities such as design and creative writing. In 2010 [41] published a report on information architecture in which IA is divided into user experience IA (application or web site level) and enterprise IA and the terms micro and macro IA are also used. The Forrester report is focused on enterprise IA.

As [42] refer, the IA provides the foundational information relevant concepts and frameworks for dealing in a consistent and integrated manner with the technology to guarantee the responsiveness and trusted information insight that the business requires from its information layer.

It identifies the information – centric components of an organization's, IT environment and defines its relationship to the organization's objective.

We might resume the IA definition as:

The description of the principles and guidelines that enable consistent implementation of information technology solutions, how data and information are both governed and shared across the enterprise, and what needs to be done to gain business - relevant trusted information insight [42].

From the perspective of enterprise architecture, information architecture views as an enterprise wide activity that includes such aspects as data architecture, metadata management and knowledge management [39]. The IA definition should be analyzed as a conceptual approach. As stated by [42], the IA definition is the first of three levels regarding the information organization and structure

in an enterprise. Those authors sum up this approach with a roadmap to define the relevant IA terms:

- The IA is the first step, and is defined in a small scope as a department or business unit;
- Applying a enterprise - wide business context to this IA we get the Enterprise IA, which is an overall;
- Finally, applying the Reference Architecture concept we get the Enterprise IA Reference Architecture.

Besides those definitions, it is also important to understand what the IA actually aims. In [43] IA is also proposed as one of the sub - architectures of the EA spectrum, just as previously described. It aims to identify the main data types that support the business development of an organization. As its result, it is intended to have the description of the informational entities that are necessary to support that business. As described in [43], the main purposes of this architecture are:

- Identify the fundamental business information.
- Define the data independently from the applications or systems that will exist.
- Provide the basis for corporative data management.

While there are different definitions, what can be agreed upon is that IA is foundational in this information rich era. Foundational implies supporting an extended perspective.

In this research, we will use the term IA as the Enterprise Information Architecture, since I consider the IA to be the Enterprise IA for this work context (ELIDI in this particular case). In this context, IA combines the background theory, design principles, structures, and diagrams representing the practical meaning of managing and gaining insight from information [44]. For my specific purpose towards information sharing, I adapt from [45] to define IA as the following:

A high-level map of the information requirements of an organization aimed at identifying major information categories and their relationships to other components that supports the information sharing processes.

We will see within enterprise architecture (EA), various descriptions of IA exist in the literature, each with their respective proponents. These range from very narrow to all encompassing, nevertheless, most IA definitions converge on the attributes, structures and interrelationships among information assets [46]. Whether focused generally on business environment or specifically on

intranets or online communities, facilitating information sharing has been mentioned as one function of IA. In terms of EA, IA focuses on information and how they relate to other components such as processes and functions. IA specifies principles, technologies and models which link the information content to the organization, process, service and technology of the architecture [47]. For example, IA describes and provides principles for implementing and analyzing effective information sharing management in alignment with the organization structure, the process specifications, and available technology. IA defines and establishes the information component of the EA by providing abstract representations of corporate information. This is where information requirements are specified at a high level, typically as subject areas, entities, and relationships.

These relationships characterize how and by whom information is used and where it flows from and to. The IA is used for understanding the information needed and used by people in performing tasks and business processes [48]. Information is created by processes and tasks and is shared with other processes and tasks [47]. In short, IA ensures that information is being described consistently so it can be managed, understood, compared, shared and composed in a coordinated manner across the enterprise.

## **2.4. Information Architecture Characteristics and Objectives**

Having covered the entire spectrum of important definitions regarding the IA, it is now convenient to understand its main characteristics and objectives. The Reference Architecture definition comprehends a set of characteristics that help to understand what this notion is about. Those key characteristics are described by [42], and are:

- Major foundational components or building blocks – they help to describe the end- to - end architecture solution.
- Common language – it simplifies communication when talking about systems of a given type.
- Framework – the Reference Architecture is a framework for scope identification, roadmap definition, risk assessment, and gap assessment.
- Foundation – it is a proven foundation for all solution designs in a domain.

In the last decade, information management and business process concepts have been fused in information systems studies [49, 50]. Growing attention on process focused approach for information studies becomes important [51, 52, 53 and 54]. A typical representative is IA which connects the information to business process, because IA is an information view on business

processes. IA not only addresses the static information structure organization, but also the dynamic process-centric view to map and visualize the information flow [55, 56, and 57].

Fisher [58] outlines a static view of ‘information-centric’ and a dynamic approach that is ‘business process- centric’:

- Static view: focuses upon structures of information elements, such as logical data model, data standards, meta-data, and taxonomy or classification [58, 59].
- Dynamic view: focuses upon processes and how information is created, managed, and used, such as a BPM, an information workflow model, and a data flow diagram [60, 61].

Figure 2.2 presents an understanding on trend and focus of IA based on timeline. IA is originated with static structure for information management. Researchers initially identify and employ the need for flexible IA in considering of the increasing complex information environment. With the increasing dynamic requirements, researchers begin to focus upon process and how information is created, managed and used [60, 61]. From the time trend, it shows that more and more attention has been focused on dynamic aspects. As dynamic concept is developing, such concept is applied back to and strengthened the context of static IA [61].

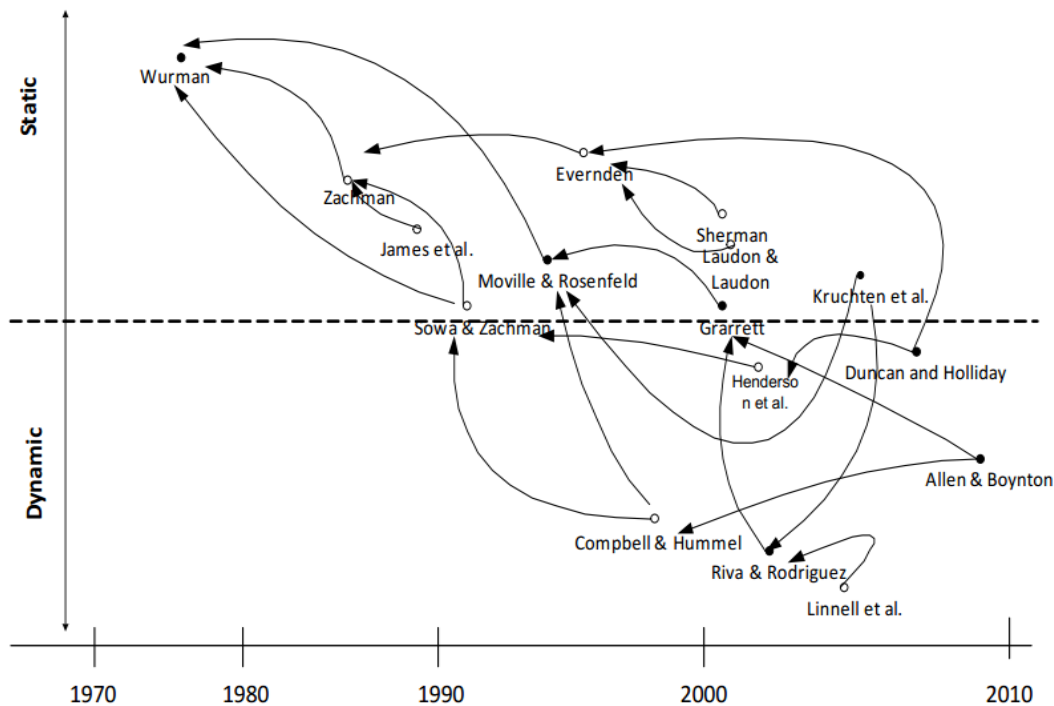


Figure 2.2. Information architecture research [62].

Visualization the information entities and attributes is another feature of IA that the visual presentation of abstract information spaces and structures facilitates rapid assimilation and understanding [63]. In this sense, it brings to the notion that visualization of information supports to identify the required information for the organization. As [62] identified and summarized IA characteristics are stated in Table 2.3, which are the foundation for the proposed web based information Architecture design.

**Table 2.3. Characteristics of IA [63].**

Static View	Dynamic View	Visualization	Organization
Data model	A BPM	Facilitate assimilation and understanding.	High-level organize the information for certain function activity to build a common and consistent Information foundation.
Data standard	An information flow diagram	Allows to understand the requirement of the organization needs.	
Meta-data	A data flow diagram	Allows evaluation of current information sharing processes	
Taxonomy or classification	A BPM		

According to [63], three concepts are important in IA: information entity, attribute, and relationship. An important issue is to address how TOGAF 9 is related with IA. From the characteristics observed from TOGAF 9 Business Process models, UML Business Pattern denotes some characteristics that is related to the IA, such as the object classes. This is a particular example of an item from TOGAF 9 model that can be linked to the information entity from an IA models. Another example is that with the Object Property List, it includes some items (such as property types) that can be related to the attributes defined from each information entity in IA. This approach views an application’s domain in terms of entities that have attributes and participate in relationships.

Characteristic of organization is noticing as it builds information as common ground to support and integrate the enterprise. An enterprise is supported with several components such as technology, organization, application etc. Based on semantics, pragmatics, and the activity theory, and some “contextual” approaches, [64] distinguished the context domains of purpose, actor, action, object, facility, and location.

Therefore, using the previous idea, and applied to the case of the ELIDI's context, We can say that an IA would be a useful tool to conceptualize the information elements of the ELIDI's information sharing system, and to assist in the information sharing process of ELIDI in the sector. The concept of IA is a formal description of how the information is structured and organized between different actors/elements involved in the operation of the Leather sector value chain in which the ELIDI is one of the actors. It is a conceptualization of ELIDI elements, their inter-relationships, and the principles and guidelines governing ICT systems used for the management of this information sharing.

## 2.5. Architecture

The term architecture might be interpreted and even defined differently within each domain. For this research purpose, the following definition was adopted [65]:

"The fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution."

Although this ANSI/IEEE definition concentrates on design and evolution, there are other aspects and characteristics that need to be considered by architectures such as guidelines and principles for implementation, operations, administration and maintenance (not just design and evolution). Another essential attribute is the description of the architecture—that is, how it is structured and described in a formal way, often by providing generic and detailed diagrams. Furthermore, a description should provide a definition and an explanation about the components and other building blocks of the architecture, its properties and collaboration among each other. The architecture description should enable subsequent steps and tasks in building the overall system. The point is that the architecture is needed to guide this research through all aspects (both technical and business) of planning, implementing, testing, deploying and maintaining business and IT systems.

Therefore, building architectures should be supported by an architecture framework. An architecture framework is based on an abstraction from multiple implementations and leverages a set of tools (such as pattern modeling and management tools) [66], or tools for logical and physical data modeling) that use a domain-specific taxonomy methods, guidelines and best practices that already incorporate important aspects, such as standards and regulations. Architecture frameworks should ease and accelerate the development of a broad range of different architectures. TOGAF is a great

example of a comprehensive industry standard architecture framework and a methodology that enables the design, evaluation and implementation of the right architecture for an enterprise.

## **2.6. General Concept of Enterprise Architecture**

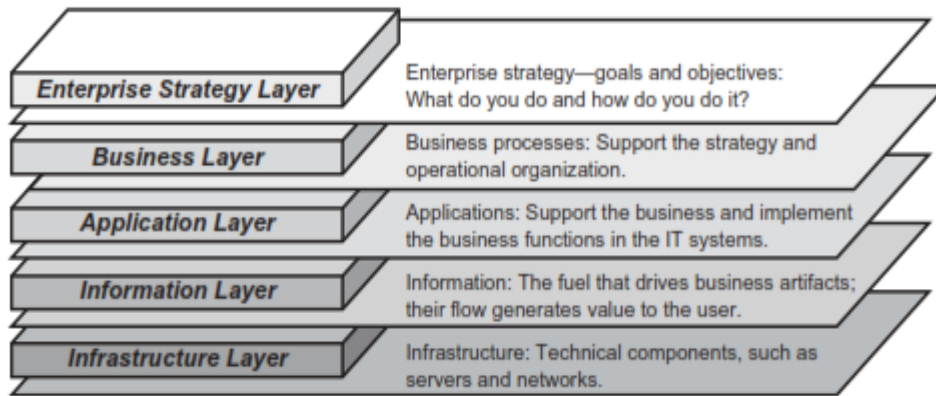
The concept “enterprise-architecture” was developed as a management tool that helped to confront nowadays challenges. For instance, a fast changing environment, and the inclusion of many stakeholders, usually adds a lot of complexity in the operations of enterprises. In these circumstances, the function of the “enterprise architecture” is to provide insights on the enterprise structure and on the way in which information and ICT systems can be used to support new functions. Therefore, the enterprise architecture, is a guideline that helps in the transformation processes that the enterprises require to adapt to its environment [68].

The concept of “Enterprise Architecture”, as its name suggests, deals with the description and structuring of an enterprise, but is mainly focused on the analysis of the Information and Communication Technology (ICT) systems that support the activities of that enterprise. It provides a framework for the business to add new applications, infrastructure, and systems for managing the lifecycle and the value of current and future environments. Enterprise Architecture provides the alignment across business strategy, IT strategy, and IT implementation. It tightly integrates the business and IT strategies to create an ongoing way to use IT to sustain and grow the business.

In the literature related to “enterprise architecture”, the enterprise is referred to as any collection of organizations that has a common set of goals and/or a single bottom line [67]. In this thesis, the aim is to apply the concept of enterprise-architecture to design the information architecture of ELIDI, where an ELIDI can be seen as a collection of many actors that pursue common goals.

An enterprise-architecture performs different functions, which can be described (formulated) in corresponding (sub) architectures. As [42] refer, the term architecture is used in a rather broad way and there are different types of architectures such as Business Architecture, Application Architecture, and Information Architecture, Infrastructure Architecture, Integration Architecture, Operational Architecture, Security Architecture, and Network Architecture. Although rather long, this list is far from complete. All of these architectures address specific situations or problems to be solved within an enterprise and are thus related in some way to the overall Enterprise Architecture.

This set of architectures allows the EA to provide the alignment across business strategy, IT strategy, and IT implementation, as stated by [42].



**Figure 2.3: The EA layers based on [42]**

This big picture from the layered view of the EA, this research deals with information architecture. According to [68] the business function is a description of all business elements and structures that are covered by the enterprise; the information function is a comprehensive identification of the data, the data flows, and the data interrelations required to support the business function; the (systems/application) solution function aims at delivering/supplying computerized IT systems required to support the specific functions needed by the business function; and finally, technology infrastructure function is the complete technology environment required to support the information function and the (systems/application) solution function.

There is no a unified definition of what an enterprise-architecture is; there is no also there a single method to develop it. Nonetheless, there exist “detailed methods and a set of supporting tools” to develop an architecture, which are called “architecture frameworks” [68]. Architecture frameworks help in different aspects of the creation of an enterprise-architecture, either by specifying methods to represent the outputs or by guiding the process to develop them.

Currently, the architecture methodology field has several leading methods developed by governments and other large institutions. Among the most recognized methodologies in the EIA field are the following four [69]: Zachman Framework for Enterprise Architectures, The Open Group Architectural Framework (TOGAF), The Federal Enterprise Architecture, and The Gartner Methodology.

Each of these architecture methodologies has areas of strengths and dedicates a significant part of its content to the creation of an Information Architecture and an EIA as a core component of an Enterprise Architecture. For many organizations, a complete EIA solution requires choosing useful areas from each methodology and modifying them according to the specific needs of the organization. In this research, we employ the TOGAF framework because it defines a process methodology which can be directly linked to the definition of enterprise architecture we used. In addition, TOGAF is already well suited for the adoption of SOA as it takes a service-centric approach to developing its architecture domains.

TOGAF is a framework for developing an EA [70]. It was developed and is currently maintained as a standard by The Open Group (TOG). The first version of TOGAF, in 1995, was based on the US Department of Defense's Technical Architecture Framework for Information Management (TAFIM) [71]. Each version of the standard is developed collaboratively by the members of the TOG Architecture Forum [70, 71].

The first seven versions of TOGAF addressed technology architecture based on its adoption in businesses. In 2002, Version 8 was published, which expanded the scope of TOGAF from a purely technology architecture to an EA, by including business and information systems architecture in the new version [71]. In 2009, TOGAF 9 was released with new features as a modular structure, a content framework specification, extended guidance and additional detail.

TOGAF provides the methods and tools for assisting in the acceptance, production, use, and maintenance of an EA [70]. It is one of the leading architecture frameworks worldwide, and in its latest version there is increasing reflection on the use of the architecture and its governance [71], being based on an iterative process model supported by best practices and a reusable set of existing architecture assets [70]. The TOGAF document focus on EA key concepts and TOGAF Architecture Development Method (ADM), a step by step approach to develop an EA [72].

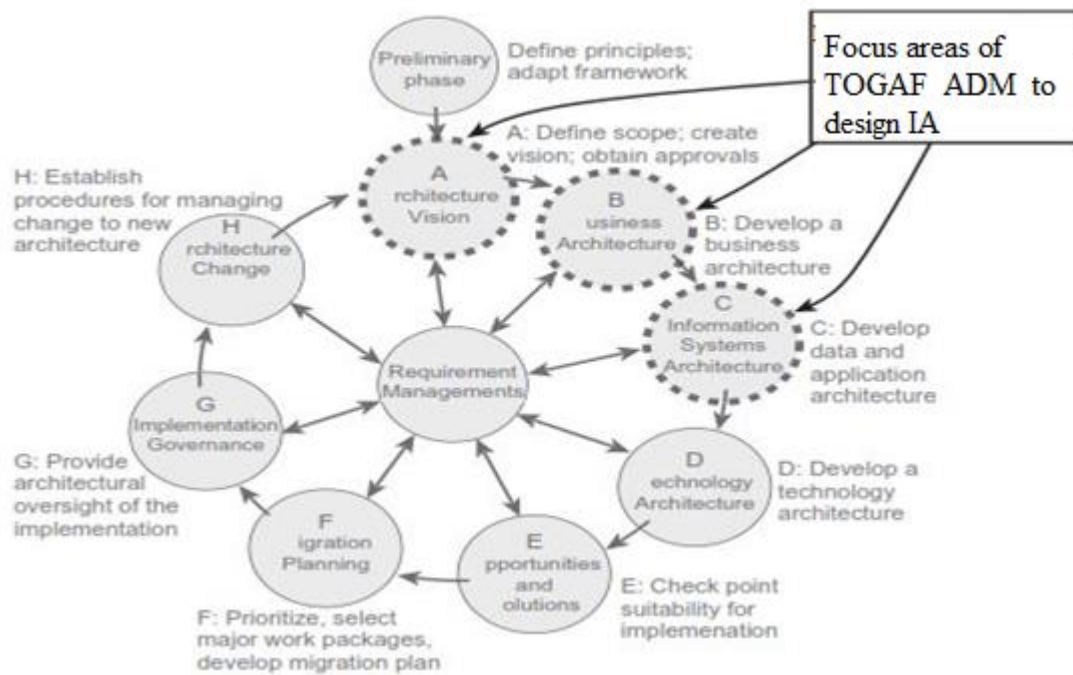
The TOGAF ADM is the result of continuous contributions from a large number of architecture practitioners. It describes a method for developing and managing the lifecycle of an EA, and forms the core of TOGAF by integrating several architectural assets, to meet the business and IT needs of an organization. While using the ADM, the architect is developing a snapshot of the enterprise's decisions and their implications at particular points in time. Each iteration of the ADM will populate an organization-specific landscape with all the architecture assets identified and leveraged through the process, including the final organization-specific architecture delivered [70].

The main phases of the TOGAF ADM are A. Architecture Vision, B. Business Architecture, and C. Information Systems Architecture, D. Technology Architecture, E. Opportunities and Solutions, F. Migration Planning, G. Implementation Governance and H. Architecture Change Management. In phases B, C, D a baseline and a target architecture are defined in each EA layer, and a gap analysis is performed to assert how to reach the intended architecture. The reason why this research select TOGAF ADM phase because the third phase in ADM cycle is Phase C, “Information Systems Architecture” which is divided in two: Information-Architecture, and Applications-Architecture and the focus of this research is information architecture.

Therefore, TOGAF is an architecture framework that enables practitioners to design, evaluate, and build the right architecture for a particular business or domains. TOGAF doesn’t specify the architecture style; it is a generic framework. Therefore, the Service-Oriented Architecture style can serve as an architecture framework within TOGAF. We consider now specifically TOGAF Architecture Development Method (ADM) which defines a process to develop an enterprise-architecture; that is, ADM describes how to develop the information architecture, providing guidelines and best practices.

Figure 2.4 is a depiction of the TOGAF ADM method. Figure 2.5 shows the various phases composing the development cycle are represented with circles, and these phases can be applied iteratively depending on management requirements (the core of the cycle, represented by the central circle). It also helps to position this research in one of the phases: the Phase C, development of the “Information Systems Architecture”.

As we may observe, there is a direct correspondence between the notion of enterprise architecture (Figure 2.3) and the process defined by TOGAF/ADM (Figure 2.4). This association is the reason to use TOGAF as the architectural framework in this thesis.



**Figure 2.4: ADM Development Cycle [67].**

Since the aim of the research is to design web based information Architecture for ELIDI we will concentrate on the following three TOGAF ADM areas that helps us to design the right Architecture for the motioned objectives:

- Architecture vision
- Business Architecture
- Information Systems Architecture

## 2.7. Summary

Information sharing is an approach for transforming information into a trusted source that can be leveraged across applications and processes to support better decisions for sustained competitive advantage. It allows organizations to achieve the information agility that permits sustained competitive advantage by accelerating the pace at which companies can begin managing information across the enterprise. Enterprises need to achieve information agility, leveraging trusted information as a strategic asset for sustained competitive advantage. However, becoming an Information-Enabled Enterprise through the implementation of an enterprise information environment that is efficient, optimized, and extensible does not happen by accident. The challenge becomes how to combine the existing information environment with new and evolving technology and processes to

create a flexible foundation for the anticipated outcome. New information management practices such as Master Data Management (MDM) and Information Services within SOA environment provide capabilities to further facilitate both the breadth and depth of capabilities required for a true Enterprise Information Architecture.

Therefore from the previous literature reviews, information architecture concept understood as an element of an “enterprise architecture”, can be used to conceptualize the business process , the relevant information, information flows, information sources and information interrelations of the ELIDI’s. To build an information-architecture, there are architecture frameworks that provide support either by defining the construction process or by defining the output product. The framework chosen in this thesis is the TOGAF framework, and specifically the ADM development cycle, which gives recommendations on how to build the information architecture. This framework was chosen because the process is fully compatible with the working definition of enterprise architecture used here.

The analysis to build the Web based information architecture should include the following elements: the context (the drivers for change), the enabling technologies (those that make the evolution feasible), the current situation of ELIDI (baseline description of the current information sharing system of ELIDI), and the target situation (the proposed architecture that will be appropriate for ELIDI information sharing). These elements provide the indispensable insight of the ELIDI’s information sharing state. Therefore it is possible to deduct the design requirements from them.

## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1. Introduction**

This chapter emphasizes on the methodology followed to conduct the research. Research methodology is the general framework of the research processes to undertake the research [73]. It is the heart of the research that helps researchers to decide how they are going to achieve their stated objectives, what new data they need in order to shed light on the problem they are going to address and how they are going to collect data and process the data. Therefore, it is required to choose appropriate methods that can provide the desired outputs.

Design science research and case study are found to be suitable for this research work. Field work was carried out to understand the information sharing practices of ELIDI. Key informants were selected from the Directorates involved in the leather and leather product development. The respondents were identified on the basis of TOGAF. The framework identified different users and stakeholders that are believed to be supportive in the design of Web based IA. These are policy makers, decision makers, supporting organizations, Sector expert, information expert and IT officers.

### **3.2. Research Methodology and Tools**

Design science research and case study are used to conduct this research. Design science focuses on the creation of innovative IT-artifacts to solve real-World problems. It, provides new knowledge through the design of innovative artifacts and the evaluation of performance of these artifacts on the other hand, case study method is chosen for it supports to investigate the interaction between the variables and the complexities in the system. It gives deeper and detail information about the natural phenomena and finds out the existing institutional arrangements, organizational settings and technological support for the information Architecture. TOGAF is a tool used to facilitate modeling, analysis for web based IA and to identify actors. These are discussed in detail in this chapter.

#### **3.2.1. Design Science Research (DSR) Methodology**

Design science research (DSR) is one of the most widely used research approaches in engineering, computer science, and information systems. Design science research, as conceptualized by [74], focuses on the creation of innovative IT-artifacts to solve real-world problems. [75] defined DSR as “Design science research is a research paradigm in which a designer

answers questions relevant to human problems via the creation of innovative artifacts, thereby contributing new knowledge to the body of scientific evidence. The designed artifacts are both useful and fundamental in solving that problem". DSR, thus, provides new knowledge through the design of innovative artifacts and the evaluation of performance of these artifacts [75, 76, and 77]. In a broader sense, the definition of an artifact includes any designed object that provides a solution to an understood research problem [78]. The artifacts that a DSR include are (a) constructs—conceptual vocabulary of a domain in which problems and solutions are defined and communicated; (b) models—which represent a real world situation by means of constructs; (c) methods—which define a set of steps to solve problems; (d) instantiations—which operationalize the constructs, methods or models in the working systems; (e) new theories; (f) social innovations; (g) new properties of technical, social or informational resources; and (h) new design and development models[77].

A number of papers proposed processes for carrying out DSR. Some of such works [75, 76]. [75,78] proposed a process model that consists of six activities that include: (a) problem identification and motivation, (b) definition of solution objectives, (c) design and development, (d) demonstration, (e) evaluation, and (f) communication. The distinguishing feature of the DSR process model is that research can be initiated at almost any step, such as a) problem-centered initiation ,b) objective-centered solution , c) design and development centered initiation and d) client/context initiation.

The aim of this research is to design Web Based Information Architecture to promote information sharing among the employees of ELIDI and the leather industries. In order to achieve this, the research first analysed the problem and identified the requirements for the Information Architecture and then, designed Web Based Information Architecture. Therefore, the methodology employed in the research is in adherence to the DSR approach developed by [78]. The procedure that is applied throughout the research is dealt next.

### **3.2.1.1. Procedures for DSR**

The activities of the DSR process model [78] were used to design IA (see Figure 3.1).

#### **a) Problem Identification and Motivation**

This research specifies research problems and justifies the need and the importance of setting a solution. Phase I is carried out to identify problems and motivation by understanding the current status (i.e. research strengths, gaps, and opportunities for further research) of the information

sharing practice of ELIDI and the result that emerges due to this practice with a focus on the Information Architecture capabilities of the institute. A review of relevant literatures was conducted to find out the status of the problem, to identify the gaps and to recognize the existing information sharing practices of ELIDI.

As stated in Chapter One, the current information sharing practice of ELIDI showed that information is shared via ordinary methods like phones, faxes, and emails and in person. This shows that ELIDI is currently collecting information in bits and pieces from different resources of the different departments. This has resulted in data duplication, unnecessary cost to collect information, time wastage and creating heterogeneous environment in the leather industries.

### **b) Define objectives of a solution**

Phase II shows that an attempt is made to creatively solve the problems taking in to consideration the existing problems and the existing knowledge. Based on the results of Phase I, the study proposed solutions to the above problems through creating ways to integrate services from different applications, creating a homogenous environment and promoting information sharing among the leather industries. The objective of this research is defined as “to design web based information architecture for information sharing and integration that enable information sharing among ELIDI employees and ELIDI with the leather industries”. The major challenges to accomplish this objective are (a) finding the landscapes in the design of web based information architecture, (b) understanding the way Web based information architecture is enacted, (c) finding out the key information sharing practices in ELIDI, and (d) finding the information requirements of ELIDI. This gives room to study how and what knowledge is needed to meet the proposed objectives. Thus, the solution is to design Web Based Information Architecture for the purpose of information sharing and integration in a systematic and modern way among ELIDI employees and with leather industries.

### **c) Design and Development**

The main artefact of the web based information architecture is created based on a series of four case studies (Phase II, Phase III, Phase IV, and Phase V). The determinants and attributes for the information requirements of ELIDI derived from the case studies and TOGAF are triangulated to the ELIDI’s specific use to construct the web based information architecture. The web based information architecture includes (i) a set of determinants and attributes of web services, and (ii) a set of web services heuristics for the design of web based information architecture. The main goal of designing the web based information architecture is to promote information sharing practice

among ELIDI employees and with leather industries. In addition , to provide guidelines for tool developers to create Web services that enrich and extend the set of services provided by this platform. In order to obtain the current information sharing practices of ELIDI, its information requirements and to analyse the Business Process of ELIDI, TOGAF framework, interviews and Questionnaires are used in this research. The interviews helped to gather information on information sharing practice from the perspectives of ELIDI and hence, complement the end-users and participants' perspectives. UML tool deployment diagram that models information is also used in this research.

#### **d) Demonstration**

A number of web service features or instruments (i.e., determinants, attributes, heuristics) identified preliminary from phase I, phase II, phase III, and phase IV are demonstrated to assess the effectiveness and usefulness of these instruments. For example, the web service instruments obtained from phase II are used to redesign a number of web based services in phase III so as to improve the understanding and awareness of the information experts of ELIDI on the web based information architecture. Phase IV demonstrates the way the web based information architecture promotes information sharing among ELIDI employees and ELIDI with the leather industries. Thus, this research tests the effectiveness of the web based information architecture to improve information sharing practice among ELIDI employees and ELIDI with the leather industries through Phase IV and Phase V.

#### **e) Evaluation**

A case study is conducted (Phase V) to evaluate the web based information architecture and to assess and measure how well the artifact supports a solution (e.g., identifies ELIDI's information requirements, which will consequently lead to potential homogenization opportunities, improve information sharing ways among the leather industries and defines guidelines for the tool developers to create web services that can enrich and extend the set of services provided by this platform). Evaluation requires the identification of the evaluation method and criteria [79]. In identifying the evaluation criteria the key questions to be addressed are identification of who will evaluate the model and specification of when and how the evaluation process will be done and how the evaluation results will be taken into account [79]. Although many literatures on evaluation of artifact indicate that there is no standard technique that can address all evaluation metrics, most companies evaluate the model using one of the three approaches: comparing the model to a golden standard (for instance established benchmark), review the model using human experts and apply the model to the target domain using domain data [79].

In this study, the artifacts designed to create web based information architecture is evaluated by reviewing the model using human experts the reason we chosen this evaluation method is in order to have clear vision for its suitability. This requires comparison between the objectives of the research and with the designed artifacts from the demonstration activity of the prototype and from the interviews. The interviewees have been selected based on their knowledge and expertise in the field of Leather and information sharing. The outcomes of this evaluation are used to refine and update the web based information architecture. The questions that were used for the evaluation can be found in Appendix V.

**f) Conclusion**

This is the final step of this research. The lessons learned will be summarized to show the significance of the research and to introduce the possible expanded ways of thinking about the research problem.

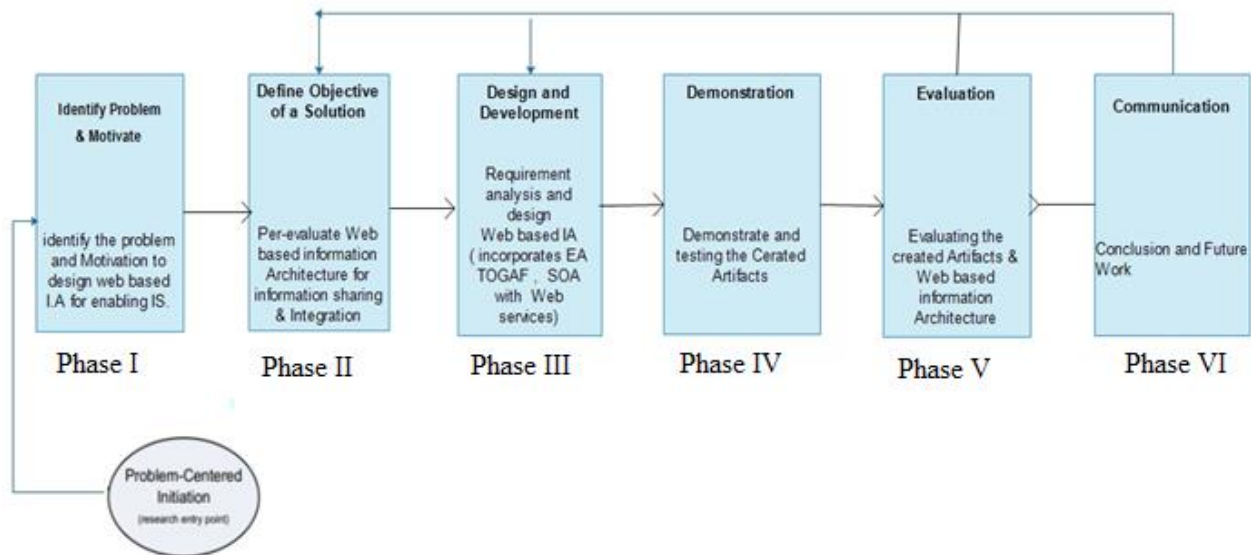


Figure 3.1. The DSR methodology process for this research [78].

To recap the above DSR Procedures, all DSR phases are summarized in table 3.1 below.

**Table 3.1. An overview of the studies carried out in this research**

Study	Study Theme	Data Collection	Data Analysis
<b>Phase I</b>	<ul style="list-style-type: none"> <li>- To find the research gaps, strengths, and challenges for future research.</li> <li>- To find a comprehensive set of state-of-the-art principles and guidelines for designing web based IA in ELIDI.</li> </ul>	literature review	Summarizing & synthesizing
<b>Phase II</b>	<ul style="list-style-type: none"> <li>- To show the significance of applying web based IA for information sharing in Leather industries.</li> <li>- To find a set of web services features or instruments for web based IA design.</li> <li>- To show the significance of applying web services concept in web based IA design.</li> </ul>	literature review	Summarizing & synthesizing
<b>Phase III</b>	<ul style="list-style-type: none"> <li>- To verified requirements catalogue for Web based IA within the ELIDI.</li> <li>- To design web based IA, which will reflect the expert-based requirements and implement possible improvements from an author's perspective.</li> </ul>	Observation, Interview and Diverse set of roles	Requirements analysis and communication & assessment
<b>Phase IV</b>	- To validated through a derivation to fulfill an industry specific use case.	Expert (analytical) Inspection	Demonstrate the artifacts
<b>Phase V</b>	<ul style="list-style-type: none"> <li>- To assess the value of web based IA in the information sharing</li> <li>- To test the effectiveness of web based IA.</li> </ul>	Expert (analytical) Inspection	Demonstrate the artifacts and using prototype
<b>Phase VI</b>	To provide a summary of achieved goals combined with an outlook of further developments and research areas.	By Demonstration	Summary of achieved goals.

### **3.2.2. Case Study**

The qualitative case study was selected as a strategy of inquiry to answer the research questions. In brief, the case study method allows investigators to retain the holistic and meaningful characteristics of real-life events [81]. It is the in-depth study which is grounded on empirical study to investigate the situation in natural settings and multiple source of evidence are used [82]. This research also follows the same path. Case study method is chosen for it supports to investigate the interaction between the variables and the complexities in the system. It gives deeper and detail information about the natural phenomena. In this research, case study is used to find out the existing institutional arrangements, organizational settings and technological support for the information Architecture. Data analysis and conclusions from this case study do not give the statistical values and results but in-depth analysis of existing system, requirements and outputs are obtained. For this purpose, ELIDI is taken as a case to study the present information sharing situation and developments.

### **3.2.3. The Open Group Architecture Framework**

TOGAF is a framework used to develop an EA [70]. It was developed and is currently maintained as a standard by The Open Group (TOG). TOGAF provides tools and methods to develop Enterprise Architecture descriptions. According to TOGAF, EA model representations should be iterative, dynamic, near real-time, and reference-able and reviewable by a larger audience at any time. This is why the ultimate goal of EA is to provide more than just architectural representations. Therefore, the TOGAF ADM is used as a tool in this research to guide the development of a set of prioritized and aligned objectives, and to provide the means for continually evaluating and understanding the organization and its architectures, as well as to communicate this understanding with stakeholders and to design different models. Hence, to communicate with stakeholders, the research structured a repository as work packages that follow the TOGAF framework. In this regard, a work package is a container that holds model representations as artifacts used in the implementation of the SOA governance capability. As the naming convention, TOGAF phases will be used as parent work packages. These will contain viewpoint packages, which are containers for model views.

Thus, this framework tries to find out which organizations are involved in the Leather and leather products, who use the information of Leather and leather products, what the business processes of ELIDI are and what the existing systems of ELIDI are (if any) using interviews. The interview questions are prepared in line with the framework to get responses on the relations that are identified in the framework. Then after, the design of the architecture is done, which is the output of TOGAF.

Finally, the validation is done by the experts in the field of leather and leather products. Due to time constraint, the designed architecture was not implemented. As a result, the information experts from the ELIDI conducted limited validation. The validation was supported by the business workflows and the study of the ELIDI information sharing system.

### **3.2.4. TOGAF's Selection**

In this section the motivation for choosing TOGAF as the most appropriate EA framework to facilitate modeling and analysis for Web based IA is presented. TOGAF was selected to use in this research due to a number of reasons: As previously mentioned in section 2.6, TOGAF is considered as one of the most commonly utilised standard EA frameworks.

Secondly, TOGAF was developed by a vendor and technology neutral organisation [70, 71]. The fact that it is vendor neutral means that it is open to incorporate in open systems as part of its solution. This is in accordance with the implication that only systems, which follow common vendor neutral conventions, can be described as open systems [70]. TOGAF is also currently published on The Open Group's public Website, and is freely available to enterprises for use and reproduction [42].

Thirdly, TOGAF's ADM provides a narrative of each of its phases, in terms of steps for the enterprise architects to implement [72]. These specified steps enable a simple, yet effective comparison to be made between them, and the steps implemented within the information Architecture phase's practical implementation, which is the core purpose of this study. The ADM's narrative is in contrast to other EA frameworks, like Zachman's, which doesn't provide a step-by-step process during the creation of a new architecture [70]. Additionally, Zachman's framework does not provide guidance on the sequence, process or implementation [42]. TOGAF is rather flexible in this regard by allowing the different phases to be combined, re-ordered, and skipped or re-shaped in order to fit the situation at hand [70].

Finally, TOGAF is strong on the business and technical architecture aspects [70]. TOGAF is designed in a manner that enables it to support Business Architecture, which defines the business strategy, governance, organisation and key business processes [42]. TOGAF's strengths in relation to the Business Architecture phase makes it an increasingly suitable framework.

### **3.3. Data Collection Methodology**

Interview was conducted to collect primary data from the key respondents. During the field visit, secondary data was also collected from government documents, reports, acts, rules, regulations and other publications was collected.

#### **3.3.1. Designing Interview Questions**

The interviews were conducted in order to gain feedback on the current practice of information sharing and the requirements of ELIDI. The interviewees have been selected based on their knowledge and expertise in the field of Leather and information sharing. The interview questions consist of open ended questions to cover the broader range of information. The questions focused on current situation of ELIDI, its information sharing practice and some opinion or experience questions. The questions were designed to get the answers about the relations that are identified in the TOGAF. Questions about present developments in information sharing activities in the ELIDI, ELIDI involved in information sharing directly or indirectly, identification of the users of Web based IA, availability of rules and regulations supporting Web based IA, different technologies and infrastructures available at present condition were asked. This type of question helped in getting knowledge about the components of TOGAF like objective of ELIDI, Goal of ELIDI, organization and institutional settings. Similarly, opinion about integration and sharing of data, assignment of key services, web based technology, different Web-services like e-payment and e-conveyancing and access to information were asked. These types of questions give idea about the enacted technology of the TOGAF that is used to design architecture as an output. Since the interview questions were unstructured, different issues that arouse during the discussion were also made clear during the interview.

Further, different sets of questions were set up for different actors identified by the TOGAF according to their organization units and positions. The respondents were chosen as such that they represent stakeholders of Web based IA. The questions were set for different level as policy, decision makers, implementing level, and Information experts. The questions that were used for the interviews can be found in Appendix III.

#### **3.3.3. Preparation of Field Data Collection**

Field work plan was prepared in advance before going to the field. Preliminary list of respondents were also identified. The respondents were identified according to the ELIDI on who are working

for information sharing activities and who participate on information gathering and what information needs for ELIDI. This research tried to focus on the information requirements of ELIDI and the requirements in the architecture and thus the respondents were also chosen accordingly. The support letter from the AAU for the ELIDI was prepared which was given during the appointments with ELIDI. Some of the respondents were contacted through e-mail and telephone as well for the appointment.

### **3.3.4. Data Collection**

Interview was used to collect primary data while other documents were consulted to gather secondary data. Both tools are briefly discussed below.

#### **Primary Data Collection**

Interview was the main source of primary data. The questions cover the opinion, experience and the present status and information sharing activities of ELIDI. Different ELIDI's Directorate Director, business experts, Participate on the Services delivery and information expert were taken as respondents. Details of the respondents are given in the sections below. All the interviews were recorded along with the notes.

#### **Secondary Data Collection**

Different work procedures, formats and other documents were collected during the field work. Regulation and vision paper of ELIDI was collected form ELIDI. Similarly, system procedure for information control and preservation for ELIDI, IT policy and reports, Enterprise Architecture (EA) was collected from the ELIDI. Some of the documents were downloaded from different websites.

### **3.3.5. Data processing**

Data processing was done manually since no complicated analysis was necessary and also the data was easy to handle. All the interviews were recorded and transcribed afterwards in MS word. The interview was conducted in English language. Total 17 respondents were interviewed. List of respondents were grouped as shown in table 3.2

**Table 3.2: List of respondents**

Type	Respondent	Number
Plan and information Directorate	Director of Plan & information directorate	1
	Senior information expert	1
	Junior information expert	1
Footwear Technology Directorate	Head, Pilot Footwear Unit	1
	Director of Footwear Technology Directorate	1
	Head, Product Development Unit (form Footwear Directorate)	1
Goods and Garment Technology Directorate	Head, Pilot Goods and Garment Unit	1
	Director of Goods and Garment Directorate	1
	Head, Product Development Unit (form Goods and Garment Directorate)	1
Leather Technology Directorate	Head, Pilot Tannery Unit	1
	Director of Leather Technology Directorate	1
	Head, Product Development Unit (form Leather Directorate)	1
Participate on the Services delivery	Research Council (RC) chairman	1
	Director General Secretary	1
	Director General of ELIDI	1
	Director of Knowledge and Marketing Directorate	1
	Head, Knowledge Marketing Unit	1

### 3.4. Unified Modeling Language (UML)

Unified modeling language (UML) is widely used specification from Object Management Group (OMG). It's a way to model business process and data structure. It can also be used in modeling application structure, behavior and architecture. OMG defines UML as “The Unified Modeling Language (UML) is a graphical language for visualizing, specifying, constructing, and documenting the artifacts of a software-intensive system. The UML offers a standard way to write a system's blueprints, including conceptual things such as business processes and system functions as well as concrete things such as programming language statements, database schemas, and reusable software components” [77]. Unified modeling language helps in designing both the structural and behavioral models. There are seven types of diagrams in UML. But in this analysis

the study use only two types of diagrams, one is business models diagrams to analyze the business processes and the second is the use case diagrams to define the roles of each member on information available and to draw the information .

### **3.5. Visual Paradigm and MS Visio**

The study used Visual Paradigm and MS Visio for the purpose of designing the models and diagrams. Visual Paradigm is a very easy tool to visualize, explore and communicate complex information. Visual Paradigm provides broad range of templates where one can draw any type of graph, table, charts, and models by using these templates. Visual Paradigm templates include: business process flow charts, network diagrams, workflow diagrams, database models, and software diagrams. The software is user friendly and its support for multiple types of diagrams is very handy. Due to its support for UML diagrams and business process model diagrams, it is comfortable to draw the diagrams in Visual Paradigm.

# CHAPTER FOUR: DATA ANALYSIS AND RESULTS

## 4.1. Introduction

Details of data collection methodology, respondents, sources of information, types of data collected were discussed in the previous chapter. This chapter analyses the data collected during the field work and produces the result which is used for designing appropriate Web based IA. Section 4.2 discusses the Ethiopian Leather and Leather Products Industry. Section 4.3 deals with the current status of ELIDI and its the organization structure, institutional settings, major services and existing technology. The information obtained from this section supports for the validation of the designed architecture. Section 4.4 highlights the responses provided by the respondents during the interview and its analysis. Finally, requirements and specifications for the architecture are discussed in section 4.5.

## 4.2. The Ethiopian Leather and Leather Products Industry

The Ethiopian leather and leather products industry is a relatively older industry with more than 80 years of involvement in processing leather and producing leather products. The industry bases itself on the country's livestock resources. Ethiopia possesses one of the world largest livestock population [83]. This enormous population of livestock provides ample opportunity for the development of the leather and leather products industry in the country. In addition to possessing large livestock population, Ethiopian cattle hides are well known internationally for their fine grain pattern and good fiber structure and are ideal for making shoe uppers [84]. As a result, the Government of Ethiopia has given top priority for the development of the leather and leather products industry in its export oriented and agricultural led industry development strategy [83]. The leather industry in Ethiopia mainly encompasses the tanning industry which produces hides and skins in different types of products ranging from pickle to finished leather, the footwear industry which also produces different ranges of shoe types including shoe upper, complete shoes for men, ladies and kids, and the leather garments and goods industry which produces leather garments, bags and different kinds of leather articles. Considering the leather industry as one part of the sector for its contribution in the economic development of the country, the Government of Ethiopia also gave emphasis to this sector and set different strategies to enable the Ethiopian leather and leather products Industry to be competitive in the world market. One of these strategies is establishing and mandating the Leather Industry Development Institute (LIDI).

### **4.3. Ethiopian Leather Industry Development Institute (ELIDI)**

#### **4.3.1. ELIDI Background**

The Ethiopian Leather Industry Development Institute / ELIDI / was established in 1998 by the Council of Ministers Regulation No 41/1998 with the name of Leather & Leather Products Technology Institute /LLPTI/. The Institute was restructured in 2010 with the Council of Ministers Regulation No 181/2010 with the name of Leather industry Development Institute /LIDI/ with the mandate of facilitating the development and transfer of leather and leather products Technologies and to enable the industry become competitive and begets rapid development. Based on this mandate the institute provides a one stop shop services from investment to marketing with the identified 18 key activities.

ELIDI had been established with the vision of developing the leather and leather products industry and thereby facilitating export revenue and employment creation. Also ELIDI is established as an autonomous federal government office having its own legal personality [5]. One of the activities of the Institute is provision of information to all leather sectors regarding new technologies, international market, new research results regarding hide and skin .etc. with the objectives to facilitate the development and transfer of leather and leather products industries technologies, and to enable the industries become competitive internationally and for the rapid development of the leather sector [17].

ELIDI has been working towards ensuring sustainable growth of the industry since its very existence. It has been exerting efforts to attract investors via providing consultation services to investors who are interested to invest in the leather industry sector.

A successful organization should deliver value added services and products to citizens and customers. ELIDI is expected to have a great share in creating value added services and products. Hence, ELIDI was restructured accordingly holding the following core value added services [85]:

ELIDI hold as the Core Values added services are [85]:

- |                               |                                     |
|-------------------------------|-------------------------------------|
| I. Customer oriented service; | V. Professional ethics;             |
| II. Readiness for change;     | VI. Occupational safety and health; |
| III. Best and fair service ;  | VII. Decent working environment;    |
| IV. Effective team work;      |                                     |

### 4.3.2. The ELIDI Structure

As discussed in the previous section, the Ethiopian government gives more attention for the leather sector and established ELIDI as an autonomous federal government office. ELIDI was structured in two main sections: The Line Section which is directly related to the leather and leather products sector and the support Section which is indirectly related with the development of the leather sector. The line Section has two subsections namely Product & productivity sector coordinator and Technical service support coordinator section to enable them perform their day to day activities.

The Product & productivity sector coordinator subsection has four different Directorates: Goods and Garment Technology, Footwear Technology, Leather Technology and Education & Training Directorates. The Product & productivity sector coordinator subsection performs issues related to the enhancement of Ethiopian leather and leather productivity and competitiveness of the sector in the international market. This section performs all issues related to leather and leather productivity development like conducting applied researches that can be adopted by the sector and improve its productivity and competitiveness, Education & Training Program, Technical Book Preparation , Identifying and developing Ethiopian leather goods and garment product standard, etc.

Technical service support coordinator subsection has also four Directorates namely Marketing, Engineering Service, Environmental Technology and Testing & Research Directorates. These Directorates participate on the development of Ethiopian leather and leather products sector via giving technical support services for the industries.

Planning and information directorate of the Support Section is only the focus of this research. This directorate has different responsibilities and activities to support the sector. The major activities of the planning and information directorate are the following:

- Support the sector for the realization of strategic management;
- Provide accurate and timely information so that transparency and accountability will be realized;
- Provide IT support to facilitate the working environment

Therefore, there is information exchange among these subsections of ELIDI and with other leather industries.

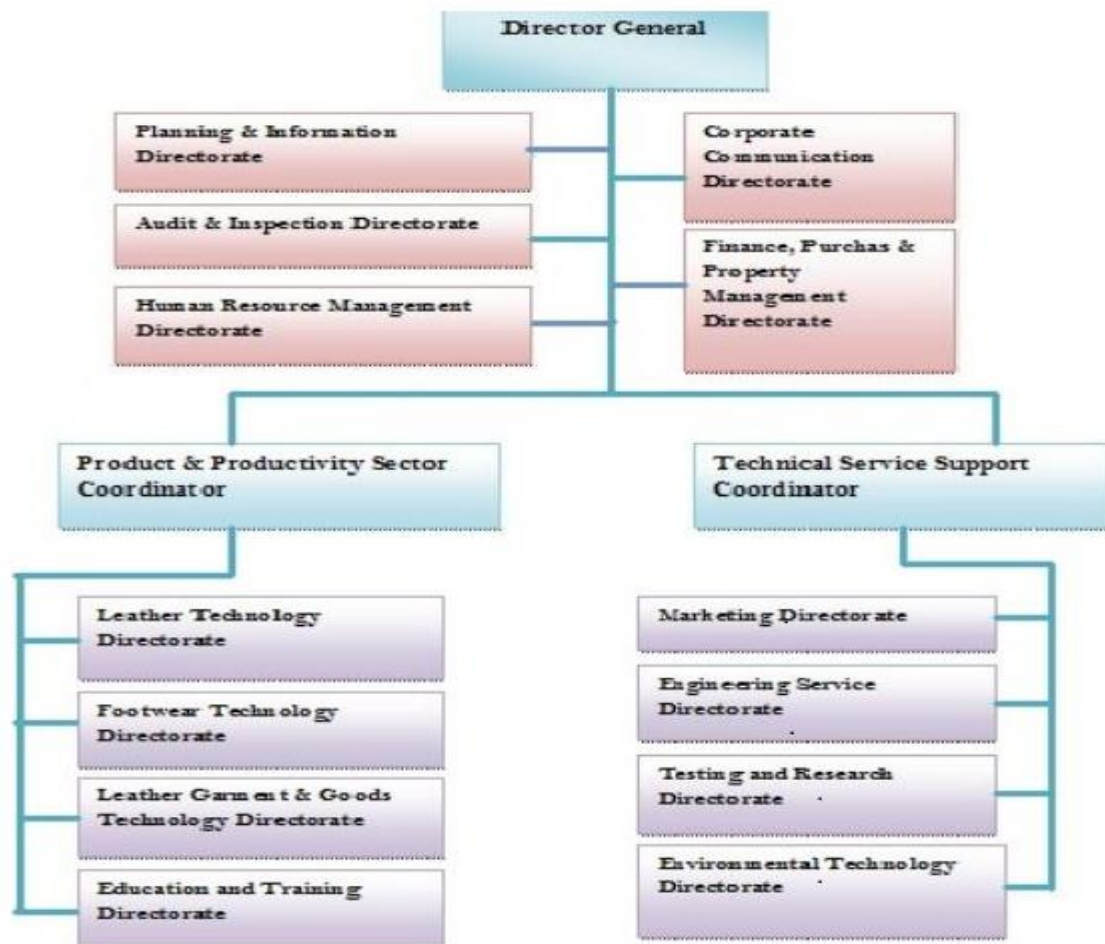


Figure 4.1: ELIDI structure Chart.

### 4.3.3. Major Services Provided by ELIDI

As discussed in the previous section, ELID strives hard to solve the challenges on the development of the sector and to meet the projected target of the Export Plan. The institute works towards the achievement of the stated goal by formulating different strategies, among which, providing standardized services to the customers of ELIDI based on the customers charter document that was prepared by the institute. According to ELIDI, the charter is prepared as an understanding document in which the institute pledges to put a level to the services it provides to the customers [85]. Additionally, this charter helps to ensure that the services provided in the investment, production and marketing support by the institute are given in a transparent and accountable manner based on the level of the pledged agreement.

Accordingly, the analysis of this research focuses on those services that provide a one stop shop from investment to marketing using the 18 key activities identified by means of web based services.

Table 4.1: shows the major services and standards provided by the Institute where this research focuses.

**Table 4.1. The major services provided by the institute and the Standard.**

S.n	Services	Place	Time	Condition	Precondition
1	Providing Information	ELIDI	With 1 hour Based customer demand within 5 Day	Soft & Hard Copy	Fulfill Prepared formats
2	Project Profile	ELIDI	Prepared: 1 h	Soft& Hard Copy	Fulfill Prepared formats
3	Feasibility study		Prepared: 1 h Studied 3M to 1y	Soft& Hard Copy	Fulfill Prepared formats, Pay fee, sign agreement
4	Monitoring Project which are in the investment Phases	In the Factories	Based on check list	Supervision, Technology transfer, Consult & technical support	Project implementation action plan & performance report, Fulfill Prepared formats
5	Technology Selection	In the Factories	Consultancy ½-2 h	Supervision, Technology transfer, Consult & technical support	Fulfill Prepared formats, if it is necessary pay fee & sign agreement
6	Technology negotiation	In the Factories	Based on check list	Supervision, Technology transfer, Consult & technical support	Fulfill Prepared formats, if it is necessary pay fee & sign agreement
7	Factory Building	In the Factories	Based on check list	Supervision, Technology transfer, Consult & technical support	Fulfill Prepared formats, if it is necessary pay fee & sign agreement
8	Machine erection & Commissioning	In the Factories	Based on check list	Supervision, Technology transfer, Consult & technical support	Fulfill Prepared formats, if it is necessary pay fee & sign agreement
9	Maintenance & Technical support service	In the Factories	Based on check list	Supervision, Technology transfer, Consult & technical support	Fulfill Prepared formats, if it is necessary pay fee & sign agreement

<b>Develop Production Capacity</b>					
<b>10</b>	Standardization & Quality	For those which are involved in leather investments in the project sites	Based on the standard		Fulfill Prepared formats, pay fee & sign agreement
<b>11</b>	Benchmarking	In the selected factories	Benchmarking data 1h & Benchmarking study for 1 product 1y	Product sample which is attach with soft & hard copy	Fulfill Prepared formats, pay fee & sign agreement
<b>12</b>	Delivering Training	ELIDI & selected factories	As the training need	Practical theory	Fulfill Prepared formats, pay fee & sign agreement
<b>13</b>	Research & Product development	ELIDI	From 3M -1y	By supportive organization if it is necessary	Fulfill Prepared formats, pay fee & sign agreement
<b>14</b>	Technique, Consultancy & Maintenance Support	ELIDI & selected factories	Based on the request	In the factories	
<b>Develop Marketing Capacity</b>					
<b>15</b>	Search Export Market	ELIDI & Different abroad	Based on the criteria		According to prepared Formats, supply annual export plan & support action plan
<b>16</b>	Market Promotion & Integration	ELIDI	Promote by providing information for leather trade exhibition	Soft & Hard Copy	According to prepared Formats, supply annual export plan & support action plan
<b>17</b>	Raw material & Product integration	ELIDI	Based on criteria		According to prepared Formats, supply annual export plan & support action plan
<b>18</b>	Export plan & monitoring	ELIDI	Providing coaching & mentoring daily	By telephone', personal contact & letter	According to prepared Formats, supply annual export plan & support action plan

Table 4.1 shows the major services provided by ELIDI. The services are divided into three parts as Project Engineering and Management, Develop production capacity and Develop Marketing capacity. The Project Engineering and Management and the Develop Marketing capacity are provided by both Product & productivity supporting services section and Technical supporting services section while the Develop production capacity is provided by the Product & productivity supporting services section.

As discussed in section 4.3.3, the services that are provided by ELIDI mainly by the Technical service support coordinator subsection is considered as technical supporting services which participate on the development of Ethiopian leather and leather product by giving technical supporting services for the industries. The Product & productivity sector coordinator subsection works to enhance Ethiopian leather and leather productivity and to become competitive in the international market.

Even though ELIDI has all these capabilities, the research focuses on the Develop production capacity capability which is provided by the Product & productivity supporting services section. According to [83] the Ethiopian leather and leather products industry comprises three major industrial sub-sectors or components: the tanneries processing and producing the leather, the footwear manufacturers (shoe producing), and the leather goods and garments manufacturers. The above three major industrial sub-sectors fall under the Product & productivity supporting services section. The reason the research focus on the Develop production capacity capability is to address the major subsections which are the backbone of the sector.

#### **4.4. Analysis of case study**

The results obtained from the interview and observation were summarized below.

The major findings obtained from the results of the interviews conducted with the Domain Expert respondents and the analysis of the service capability of ELIDI showed that the current business process, information sharing practice and the way of service delivery method of ELIDI to customers is through documents, seminars, and trainings. The services capabilities of ELIDI are found to be delivered based on manual system where data redundancy is common, information is collected in bits and pieces from different resources, required information is stored in different applications and owned by different members in the supply chain and not integrated into single view. Decisions are made on the basis of experience and quality of decision depends on the information available at the spot.

It was also identified from the observation and interview that there is no web based information sharing facility which leads the directorates to exchange information manually. The respondents believe that this creates an information gap with in different sections of the directorates as well as with other directorates, makes access to resources difficult, creates delay in exchanging reports as these passes through many levels, information are vulnerable to damage and quality problems due to security and control problems while employees do not have a clear privilege to access information.

The respondents also believed that all the data related to the sector should be kept in central database and the accuracy should be maintained. The respondents also stated that web based IA is helpful to reduce data redundancy, facilitate information sharing and increase accessibility of information. Finally, the respondents recommended that the development of web based IA to be the most essential task for the initiation of ELIDI information sharing activities.

## **4.5. Requirements and specifications**

The requirements are identified from the respondent's interview and the results from the previous research done in Leather and leather products for ELIDI. Interview during the case study was done to get the idea about ELIDI's requirements. Thus the researcher were also identified the requirement of ELIDI. Requirements in ELIDI are collected from field study. Then after, specifications are defined according to the selected directorate. These requirements and specifications are further used for designing purpose.

### **4.5.1. Requirements for ELIDI**

Requirements for ELIDI are identified after transcribing the interviewed data. Interviews were transcribed and clustered accordingly. The analysis of the interview data was done in previous section 4.4. Requirements are discussed in the following aspects as below.

The present system that is being used in the ELIDI are isolated single application based system. All the directorate have their own data. The service that the directorate are providing is not web based but just conversion of the paper to computer system. Thus, development of web based IA is another requirement. This supports ELIDI's information sharing activities. Use of ICT and web technology helps in interaction, participation and collaboration between directorates along with easy exchange of information between ELIDI directorates and the users.

After the development of web based IA, it will also be possible for providing online information to the users. At present, people go the ELIDI and search for the required information in the paper

records. Online information supply reduces wasting of time and also reduces public flow to the ELIDI, thus reducing the crowd and maintain good environment for the service. Information is used by the Sectors, Government, Leather association and ELIDI employees. If users wants to get some information or services, they then need to go ELIDI personally and ELIDI also provide the requested information or service accordingly. This reduces the efficiency as well. This type of problems will be eliminated by online information system.

Quality of service is most necessary to be maintained in order to satisfy the customer which leads to the sustainability of the leather sector. The system need to be easily understandable, usable and adaptable to the ELIDI. Efficiency is expected to increase by the implementation of the web based IA.

Another requirement observed is integration of ELIDI service as well. Separation of services produces duplication of work and time delay as well. Duplication of work, more stops and complex procedure are some of the problems in present organization structure.

Concept of Centralize Databased is to integrate all ELIDI data in one single place. This supports in access to all the data from one single port. Thus, data integration into centralize Databased is identified as another requirement in ELIDI. This helps in integration, linking and sharing of data between directorates.

## **CHAPTER FIVE: DESIGNING ELIDI's IA**

This chapter corresponds to the “Define objectives of a solution” and to the “Design and Development” steps of the DSRM process, where we explain our approach and design a solution to the stated ELIDI's problem.

Based on the problem described and on the lack of suitable solutions, we propose an EA integration through the definition of an Enterprise Architecture, with principles, concepts, methods and models, for organizations that need to manage ELIDI's services. This architecture should use the EA approach for organizational business and strategic alignment, along with the TOGAF framework and UML for modeling ELIDI's Information Architecture.

The purpose of this research is to design a web based IA for the sharing of information among Leather and leather products industries in Ethiopia. As with any architecture, this chapter provides decision-making guidance; in this case, the architecture supports more consistent, efficient, and effective decision making regarding the planning, design, acquisition, and implementation to enable the sharing of Leather and leather products information. Moreover, the architecture guides the leather and leather products industries to exchange information in a way that minimizes unnecessary dependencies between systems, maintains agency autonomy to govern internal business processes, and improves the ELIDIs' collective ability to respond rapidly to new business needs and opportunities.

This chapter is divided in to four sections, which correspond to the first four phases of the ADM development cycle. Section 5.1, describes a preliminary phase, which aims to provide a description on how the architectural work for the ELIDI's Information sharing would be done. Section 5.2, addresses phase A “the Architecture Vision”, which is intended to define the scope, clarify the vision, and to identify the stakeholders. Section 5.3, phase B “Business Architecture”, gives insights on the ELIDI's business capabilities, ELIDI's business organization, ELIDI's business Service/Function, ELIDI's business process information . Finally, Section 5.4, describes phase C “Information Systems Architecture”, where defines the necessary data, and data sources to support business functions followed by designing the information Model.

### **5.1. Requirements Management**

This study has established an enterprise architecture program to develop a coordinated direction for designing and implementing web based IA solutions for the sharing of information between

employee of ELIDI and with the leather and leather products industries. The information architecture contains the content of information of ELIDI's services and an integration architecture that will specify how those interfaces are implemented from a business functionality standpoint.

This research specifies the technical architecture for integration of and with enterprise applications at the ELIDI. It lists principles that should be applied to future application integration initiatives, and highlights the endorsement of existing principles from other domain teams. It continues to state the business and technical benefits obtained from the design architecture and the summary of key findings from the domain.

### **5.1.1. Objective of a Solution**

The purpose of this research is to establish a content architecture for the sharing of information between the employees of ELIDI and the employees of the leather and leather product industries. As with any architecture, this study provides decision-making guidance. The architecture supports more consistent, efficient, and effective decision making regarding the planning, design, acquisition, and implementation to enable the Leather and leather products share information. Moreover, the architecture guides the partners to exchange information in a way that minimizes unnecessary dependencies between systems, maintains agency autonomy to govern internal business processes, and improves the partners' collective ability to respond rapidly to new business needs and opportunities.

In order to accomplish this, the architecture defines a set of standards, guidelines, and requirements around a small set of key decisions typically encountered in information sharing projects:

- At what points should we exchange information?
- How do we describe information exchange points to reduce development costs and promote reuse?
- What data format should be used for information exchange?
- How should systems communicate (what protocols and technologies)?
- What infrastructure capabilities do we need to share in order to maximize the return on our infrastructure investments?

The following responses present a brief summary of the decision-making guidance contained in the architecture:

- View information exchange points as services through which ELIDI makes business capabilities (functionality) available to other industries.
- Systems interact through services, not by directly communicating with one another in order to keep their implementation separate.
- Derive identification of services from the business processes and strategic business objectives.
- Use industry-standard formats and protocols to enable information exchange between the industries to enhance maximum interoperability and solution choice.
- Separate the business rules and logic of information sharing from the ELIDI systems that provide and consume information to promote agility and responsiveness.
- Share infrastructure that supports all of the above and facilitates secure, reliable transmission of information among partners and systems.

Using enterprise integration, this researcher has made a strategic decision to address the challenge of their silos of IT systems by separating out their processes into business functions. One The major business driver is the need for ELIDI to improve the way it gives services to its customers and business agility. The respondents from ELIDI have also suggested that SOA strategy will best help meet the goal of ELIDI. The executive steering committee of ELIDI believes that implementing a common enterprise architecture approach across the entire information sharing process will take a significant amount of time and effort though it is an achievable goal. If the business organizations adopt a shared set of business and IT standards, it is possible to ensure a flexible SOA. The steering committee has also agreed on the proposed web based IA for the purpose of information sharing & integration at ELIDI. Additionally, ELIDI Infrastructure Design Authority has selected to use as a new enterprise platform services capability. Now the task ahead of the researcher is to build the business solution for ELIDI. To guide the creation of the ELIDI's content architecture.

## **5.2. Preliminary Phase**

This starting phase of the ADM cycle is there to prepare the enterprise organization, or in this case the participant for the development process. This includes in the case of a service-oriented solution the presentation of the service orientation principles, the consideration of existing reference architectures and models for SOA, and the elaboration of a governance

strategy for the planned SOA solution [67]. Thus the SOA development using TOGAF/ADM is intended to prepare the enterprise for a successful “architectural work”, which is the design of an information-architecture. The main objective of this phase is to delineate how this design work will be done.

### **5.2.1. Approach for the Information Architecture**

The starting point for SOA development with TOGAF is that the enterprise adopts service-orientation as an architecture principle [67]. The concept of Enterprise Architecture, as used by TOGAF in the ADM cycle, refers to a work made for the internal use of an enterprise in order to guide the development of information assets. Therefore, an important part of the Information-Architecture construction is devoted to connect the architectural work to the internal organization of the enterprise in to ensure adequate support.

The purpose of IA is to represent the information needed for the adoption of a web based information architecture to be used for the information sharing process of ELIDI. This information is the one required to adjust the information sharing activities to the ongoing process of the web based information Architecture design to share and integrate information in the context of ELIDI. Hence, the requirements for the architecture are determined by these two events.

IA is designed to provide a common framework for the cost effective information sharing of ELIDI within and across organizational lines while respecting the security, privacy and appropriate use of that information. It must enable ELIDI to manage information as an asset to better serve the Leather and Leather products industries of Ethiopia. It increases ELIDI’s agility in drawing out the value of information as a strategic mission asset.

### **5.2.2. Architectural Definition**

The objective of this step is to perform an analysis of the target architecture from a number of concerns (requirements) or viewpoints and to document each relevant viewpoints. The purpose of considering these viewpoints is to ensure that the concerns of all relevant stakeholders be considered in the final target architecture so as the target IA meets all the requirements put on it.

## **5.3. Phase A: The Architecture Vision for ELIDI**

This is the first phase of the ADM cycle. Its main objective is to define a clear vision for the architectural work to fulfill the purposes defined in the preliminary phase. In this case, the vision of architecture is to develop a high-level aspirational vision of the capabilities and business values to be delivered as a result of the proposed enterprise architecture. The vision of the architecture must mention that the scope is to develop up to Information architecture Model to design web based IA of ELIDI using SOA styles by Identifying the Business Architecture components and analyzing the information required for the information sharing activities of ELIDI and mapping it to the Information Architecture components. Other elements of the architectural vision can be deduced from the following information.

### **5.3.1. Important Elements to Build an Architecture Vision**

#### **1. The Business Motivation**

The information sharing between ELIDI and its employees and with the sector involved in the leather and leather products process is essential to the effectiveness and efficiency of the sector. The availability of accurate and timely information in the hands of the right decision-makers at the right time is a necessary component to reduce and improve the efficiency of ELIDI and the leather industries. The integration of systems and the automated electronic sharing of information eliminate error-prone redundant data entry, lead to improved information quality and security and better-informed decisions. Integration speeds up the access of decision-makers to records and information and improves the efficiency of the work process of ELIDI.

#### **2. Vision and Mission of the Institute**

Generally ELIDI has Vision & Mission which is to see the share of the Ethiopian leather Industry grow tenfold in 2023 in the global market as Vision and expanding the Ethiopian leather industry sustainably and fast, promoting investment, providing the investor with production and marketing, technologies, counseling and support services; making Ethiopia gain the most out of its leather resources as mission.

#### **3. The Business Goals**

The goal of this research is to develop an information architecture that supports the information sharing activities of ELIDI. This architecture provides concrete, objective and formal guidance to the information sharing activities of ELIDI regarding how the information architecture should share

data and its functionality. It is expected that the leather industries will use the architecture to guide the planning, design, acquisition, and implementation of systems within their own environment wherever these systems provide information to ELIDI or consume information from ELIDI. It is also expected that the architecture to guide and inform the design and acquisition of shared, common infrastructure to support the inter-system (inter-partner) exchange of information. In the case of ELIDI, it established its goals that are stated on the customers Charter to solve the challenges on the development of the sector and to meet the stated target by Ethiopian government (ELIDI customers Charter). By expanding the Ethiopian leather industry sustainably and fast, promoting investment, providing the investors with production and marketing, technologies, counseling and support services; making Ethiopia gain the most out of its leather resources. Accordingly to the director of Information, Planning & Monitoring pursue these goals by designing their own goals that is support the goals of the ELIDI which is supporting the sector by the realization of strategic management of work, by evaluation of policies and strategies concerned with sector; whether they are being implemented as planned or not and conducting research on selected priority issues, by designing a consistent reporting system for monitoring and evaluation of the plan and by providing accurate and timely information so that transparency and accountability will be realized.

The Information, Planning & Monitoring directorate constantly and dynamically gathers and processes data to create information needed to attain its mission whether it is promoting investment, Marketing, Transferring technologies, environmental protection, or other direct services. The Information, Planning & Monitoring directorate has different activities where the major activities are the following.

1. Corporate planning, monitoring & evaluation

- Creating linkage between the mission and vision of the sector; and Government policies and strategies
- Monitoring and evaluation of performances, take actions based on the findings and produce a report.

2. Data collection, organization & dissemination

- Production and dissemination of accurate and timely information which supports the sector.
- Designing a conducive environment for information management system
- A centralized information service
- Customer feedback and analysis system
- Sector oriented, current and correct information

- IT supported inter sectorial information exchange system

The Vision: Enterprise data and information is managed as an ELIDI asset to provide value to the leather sector and stakeholders.

The Data Strategy vision points towards the future unlocking of the potential of ELIDI data assets.

The following goals support this vision.

**Goal 1: Implement an enterprise data management program.**

Data management will provide a common framework for the cost effective information sharing of ELID across organizational lines while respecting security, privacy and appropriate use of information.

**Goal 2: Enable enterprise data sharing**

Create structures that support collaboration among stakeholders, and facilitate the responsibility to provide culture across the ELIDI to share data, information, knowledge and expertise.

**Goal 3: Establish Data Governance and Oversight**

Business and IT leaders must provide governance and oversight to ensure that the direction set and decisions made to carry out the data strategy remain in line with the business strategy of ELIDI.

These goals are building blocks for a solid foundation to leverage the data assets of ELIDI. The continued commitment and participation of ELIDI's stakeholders in advancing this vision is necessary to keep this model responsive to ELIDI, the leather sector and the governmental organizations.

**4. The Strategic Drivers**

It is assumed that to achieve the established goals of ELIDI, the institute strives hard for the success of the stated goals by formulating different strategies. One the strategies is to provide standardized services to customers based on its customers charter document and based on its pledge to put a level for services it provides for the Customers. Additionally, it planned to make the country beneficiary from its enormous raw material base in the leather sector and to fulfill the projected target of the export plan. The main strategic driver of change for ELIDI is the need to cope with these three events.

**5. Stakeholders**

There are the “entities” with some interest in the development of an IA for the Target information sharing activities. The stakeholders are defined as the “prime movers who must make happen the deployment of IA”. In the strategic development plan for the collect, analyze, organize and transfer to the sector's data center and disseminate to users, as may be appropriate, data necessary for the

development of leather and leather products industries the director of information, Planning & Monitoring directorate have major roles, they are the end users which is the employees of ELIDI ,all leather and leather products industries (Tanning Industries , Leather and Garment industries , Footwear Industries and Glove Factories), Ethiopian Leather Industry Association , COMESA/LLPT, Investors, researchers and policy makers of the sector, Trade associations , Consumers associations, Regional industry & investment bureaus , Customs and revenue authority, Chemical Association and Central statistics agency becoming information producers and service users in general with emphasis on Leather and leather products industry, which design the enabling technologies for making the information sharing activities feasible.

## **6. Objectives of ELIDI**

ELIDI is an autonomous federal government office having its own legal personality with the primary objective of facilitating the development and transfer of leather and leather product industries' technologies as well as enable the industries become competitive and beget rapid development [5], supporting the sector through the realization of strategic management of work, providing accurate and timely information so that transparency and accountability be realized and facilitating the work environment via IT support.

As stated on the customer's charter, ELIDI has the following objectives

- a) To ensure customers right to information.
- b) To provide quality services to customers.
- c) To insure accountability.
- d) To notify the kind of services, time and standard delivered to the customers
- e) To lay down conditions to ensure customers sense of ownership, and air their comments to the institute.

## **5.4. Phase B: The Business Architecture**

The construction of a Business Architecture is the second phase of the ADM cycle. Business architecture relates business strategy to ICT. The Business Architecture identifies the functions, process, organization unit, and information flow to achieve the objective of ELIDI. Business architecture cannot contain all the minor details of the business because of the restrictions in the modeling language, but it focuses on the core business task and the key mechanisms [86]. However,

it tries to clarify the complexities within the organizations and support the initiative to the development of further functional applications [87].

The business architecture captures the enterprise's core mission and the business practices of the enterprise as the primary set of requirements for the information architecture that need to serve. It represents the enterprise's most important work activities and assets. This phase consists of describing the ELIDI's "business", which is embedded on the leather and leather products information sharing utility. Develop the Target Business Architecture of ELIDI that describes how the enterprise needs to operate to achieve its business goals, and to respond to the strategic drivers set out in the Architecture Vision in a way that addresses the request for Architecture Work and concerns of stakeholder.

The business architecture shows the processes that ELIDI performs and provides a framework that allows IT to map its activities in line to business processes. Therefore, this section includes the baseline of the current and target (TO-BE) organizational, functional, process, information, services and geographic aspects of the Architecture with the focus on the information architecture. Moreover, the description provided in Chapter 4 (Overview of ELIDI) is useful to define the business architecture.

### **5.4.1. ELIDI's Capabilities**

In order to understand the capabilities of ELIDI, functional decomposition diagram is created. Using the functional decomposition diagram presented the capabilities of ELIDI that are relevant to the consideration of an architecture and by examining the capabilities of ELIDI from a functional perspective, it is possible to quickly develop models of what the organization does without being dragged into extended debate on how the organization does it. Being totally disconnected from the business goals and capabilities, the resulting IT system suffers from agility issues in aligning service descriptions to the changing business decisions. On the other side, it is difficult to capitalize the business processes to align IT applications with the changing business decisions as business processes evolve frequently in time. So we need to look for more stable elements that are the "business capabilities" of the organization - capacities that a company should possess or exchange to support its vision. A business capability describes what the business does (outcomes and service levels) to create value to the organization and its customers. The concept of business capability is referenced from TOGAF 9.1 Architecture Content Meta Model [67] with link toward business functions, processes, services and IT layer components. Indeed, the capability elements of the meta

model of TOGAF 9.1 need to be directly linked to the Motivation Extension ( Driver, Goal, Objective which are illustrated on the Architecture Vision) elements so as to measure direct impacts of strategic changes on the business capabilities of the organization. In the TOGAF SOA Entities Content Meta Model [67], the Motivation Extension elements need also to be linked with the Business Capabilities and Functions so as to align business and IT system components to the strategic changes. Consequently, based on the focus of the research, the following functional decomposition of ELIDI is created as illustrated in Figure 5.4.



Figure 5.1: ELIDI's Focus area's functional decomposition

According to TOGAF 9.1 Meta Model, business functions are designed to "deliver" business capabilities where each business functions are bounded by a business service that provides governed interface to access the business function. This means, the capability components created in section 5.4.2 are supported by a set of underlying business functions that collaborate to deliver the business value expected from the capability (i.e. realize its goal). In order to realize this goal, business functions that are part of each capability are orchestrated by a business function whose access is governed by its corresponding business services.

As motioned in chapter four, 18 key activities of ELIDI that are geared to provide services from investment to marketing were identified. To describe the research focus of the business, we have to recognize its main services with respect to the ELIDI's functionality. Of special importance is to recognize the services that are critical for the leather and leather products and from those 18 key activities the research can depict the current situation of ELIDI as formed by Business Service/ Function catalog: the organization unit with their business function and business service that show the focus area of the research which is Develop Production Capacity capability. This is illustrated in the table 5.1 below.

**Table 5.1: Major ELIDI's Activates with the with their business organization unit**

Business Service / Function Catalog		
Organization Unit	Business Function	Business Service
Goods & Garment Technology Directorate	Develop Production Capacity	<ul style="list-style-type: none"> <li>- Research &amp; product development service</li> <li>- Pilot Plan facility service</li> <li>- Consultancy service</li> <li>- Design new processes and develop new product services</li> </ul>
Footwear Technology Directorate	Develop Production Capacity	<ul style="list-style-type: none"> <li>- Research &amp; product development service</li> <li>- Pilot Plan facility service</li> <li>- Consultancy service</li> <li>- Design new processes and develop new product services.</li> </ul>
Leather Technology Directorate	Develop Production Capacity	<ul style="list-style-type: none"> <li>- Research &amp; product development service</li> <li>- Pilot Plan facility service</li> <li>- Consultancy service</li> <li>- Design new processes and develop new product services</li> </ul>

After having Business Service / Function catalog, decomposition of these capabilities in to component of business objects continued. Using such an object-in-state modeling of the capabilities, the responsibilities assigned to each capability component are expressed by an actionable state that determines the goal to be reached on the corresponding object. Accordingly, the number of capability components of ELIDI is illustrated. These components were obtained after the decomposition of a first level capability cartography elements that may be constituted of business functions like PDU, GTD, KMD, FPD, IPD, PTU, LTD, KMU, PFU, FTD, PGU, DG, and IPU.

As indicated above, the business Service / Function Catalogs of footwear Technology, Goods & garment and Leather Technology Directorates have delivered this capabilities for their users. Thus, we can put the capability of those Directorate under the Develop Production Capacity capability accordingly the researcher develop capability model in order to identify each business function, business entities , their states and relationships.

#### **5.4.2. ELIDI's Service Capability**

From the above Functional Decomposition and Business Service / Function Catalog, the next capability structure is developed. It helps to understand the requirements of the business function that deliver each capability of ELIDI and inventory of the functions in the AS-IS situation. Therefore, understanding of the capability structure of ELIDI answers the questions, “*what the key information sharing practices of ELIDI are? And what the leather and leather product-information contents are required for ELIDI's IA according to the requirements of its line directorates?*”

#### **Develop Production Capacity capability**

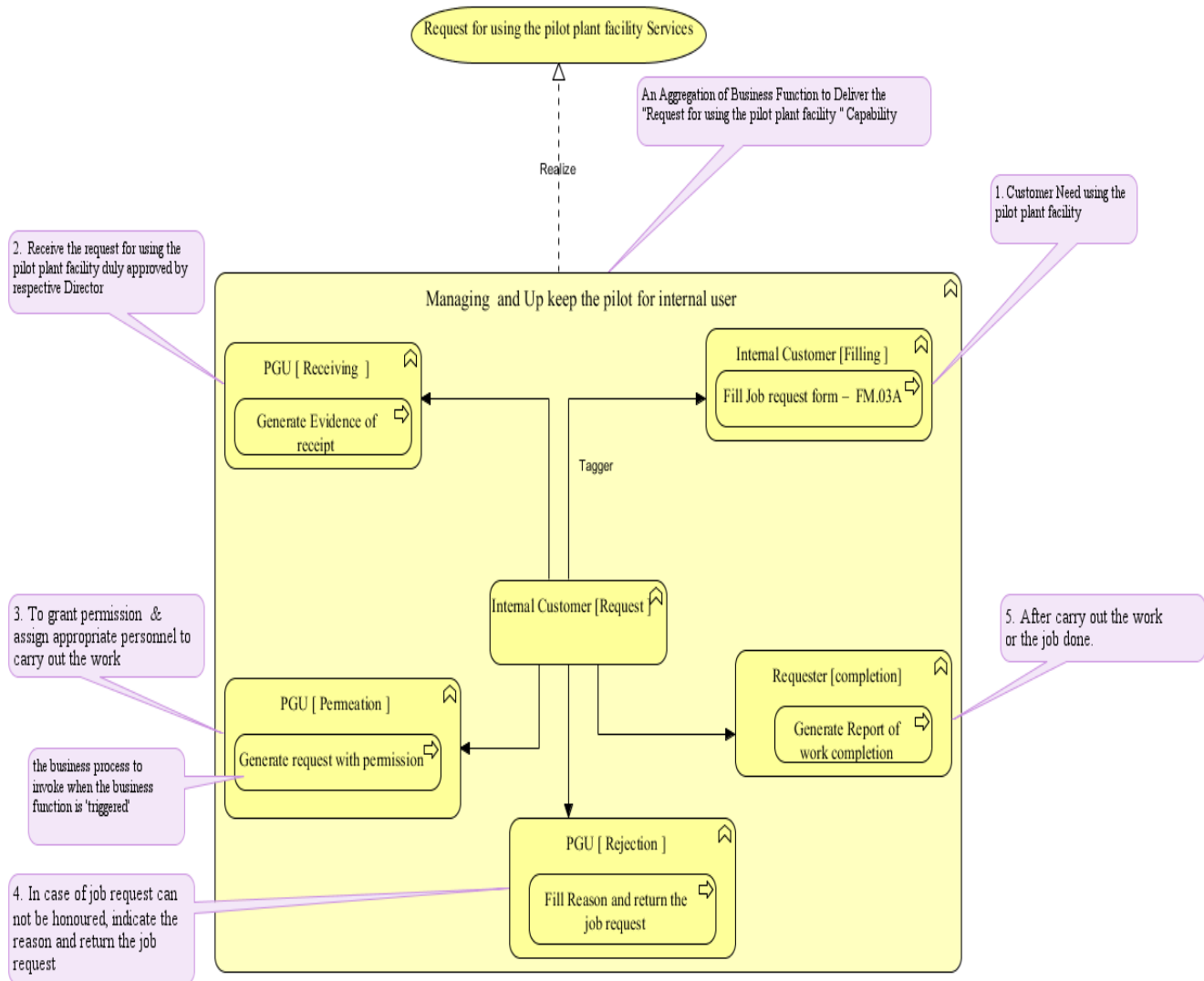
##### **1. Pilot Plant facility Service Capability**

All the works carried out in the pilot Goods and Garments unit, which are not covered under any other business processes, are brought under this process. The head of PGU shall prepare business plan for the pilot Goods and Garments unit every year. Under this there are two condition which are

- A. Use of pilot Goods and Garments unit- for Internal user
- B. Use of pilot Goods and Garments unit- for External user

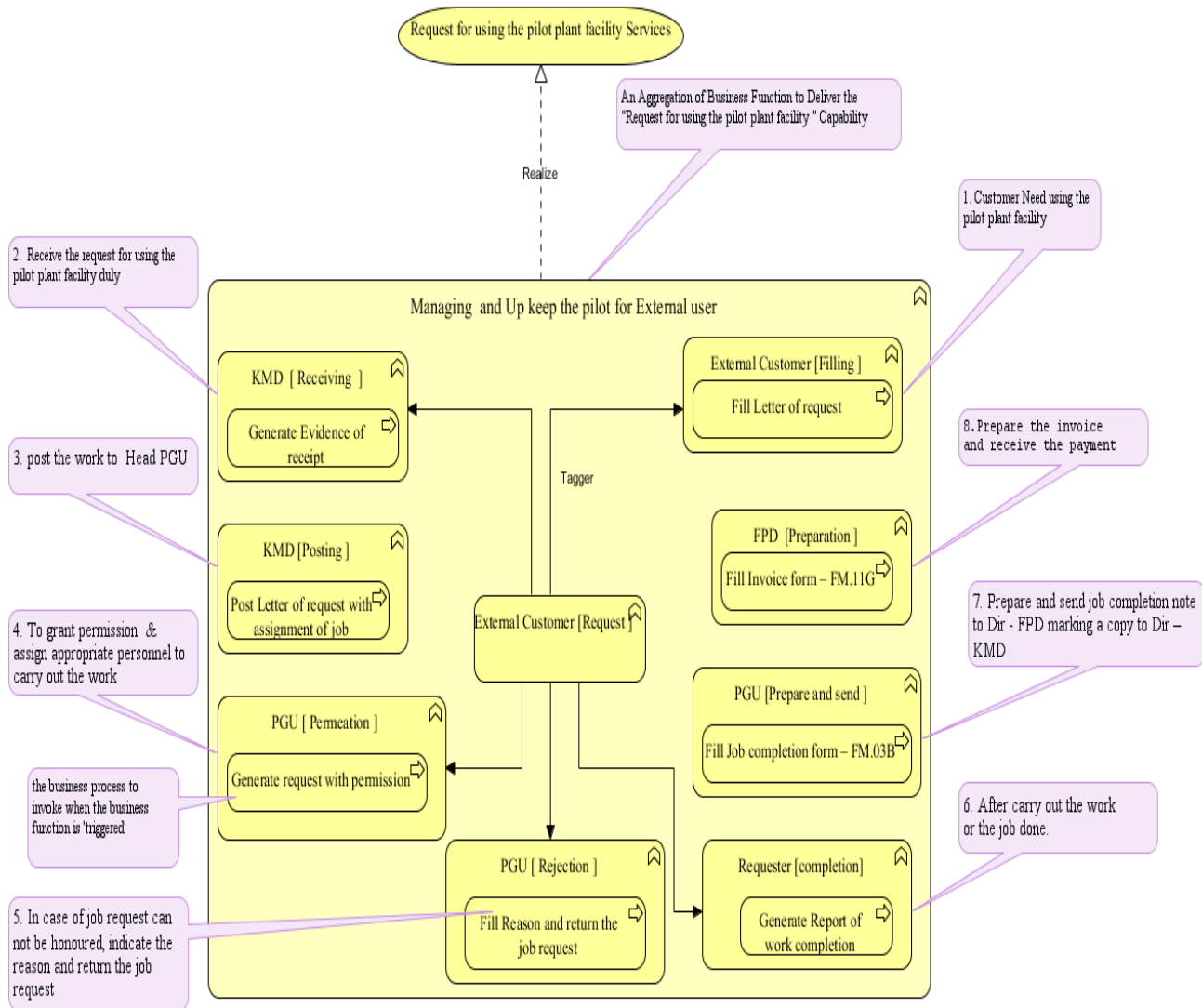
## A. Use of pilot Goods and Garments unit-Internal User

The view depicted below illustrates the business capability and function presented on the basis of service deliveries of ELIDI. It expresses the OMG's business architecture capability view using business function, business entities, their states and relationships.



**Figure 5.2: Request pilot Goods & Garments Services Capability for internal user**

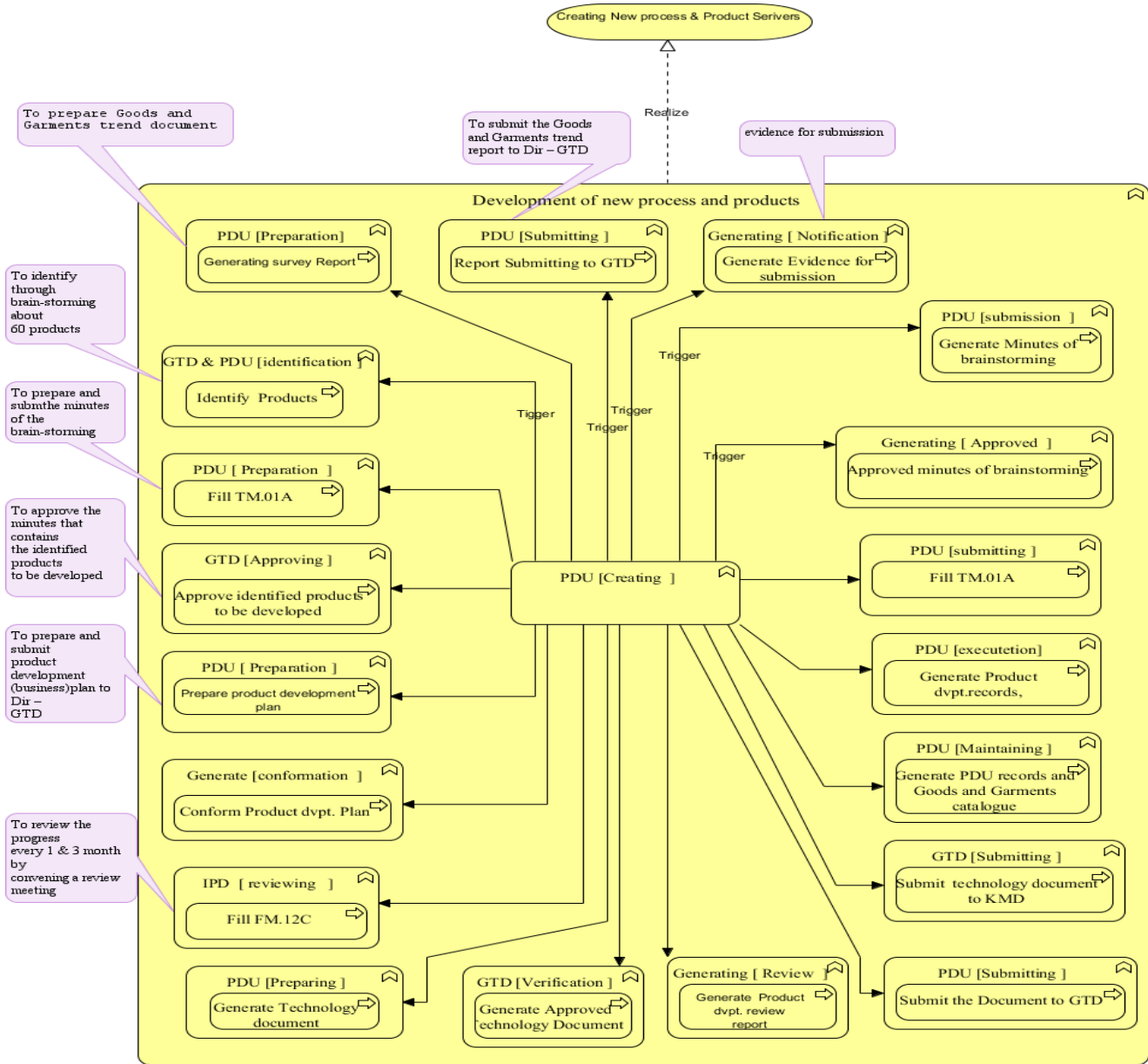
## B. Use of pilot Goods and Garments unit- for External user



**Figure 5.3: Request pilot Goods & Garments services Capability for External User**

### 2. Design new processes and develop new products Service Capability

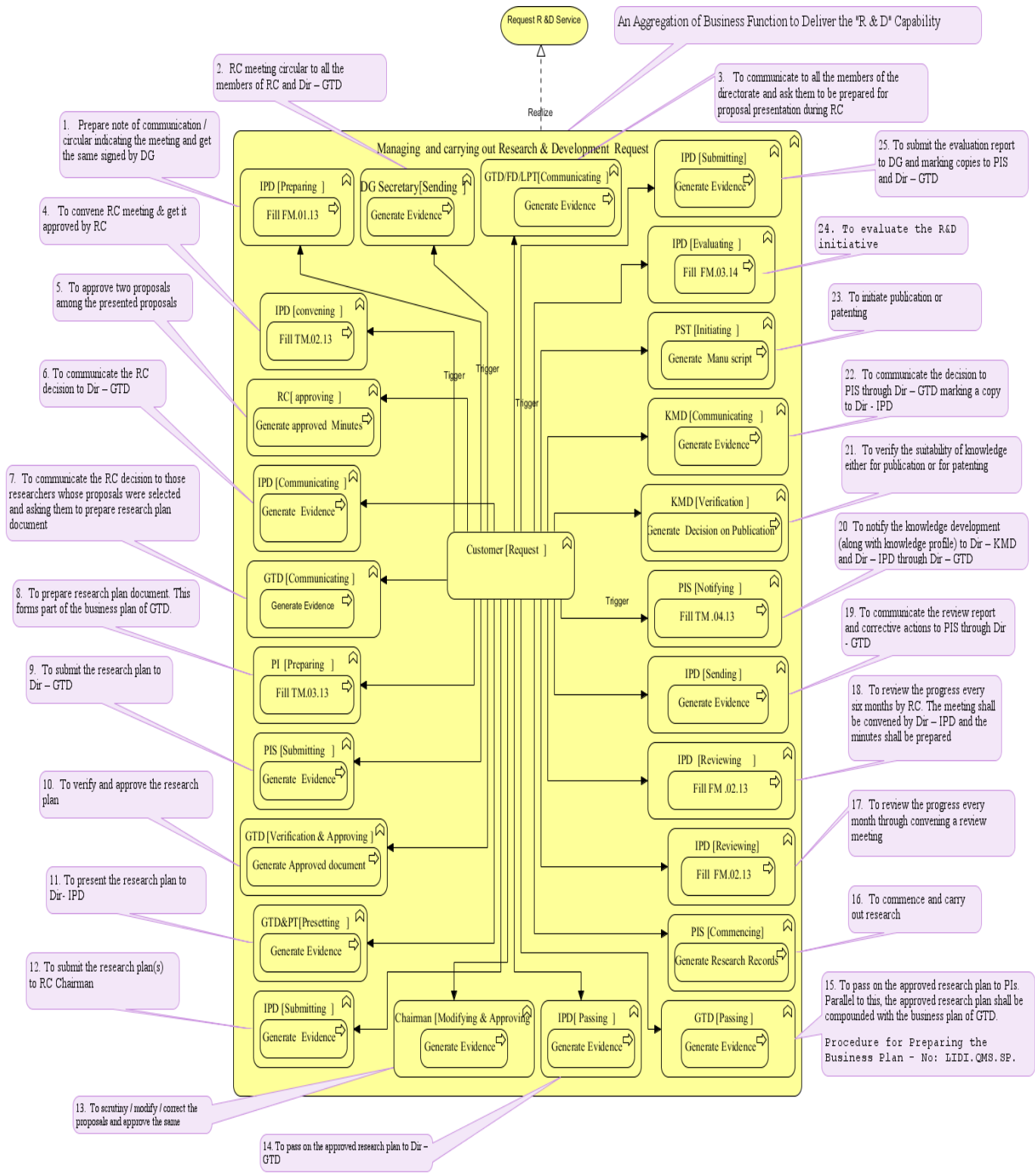
The other capabilities identified are designing new processes and developing new products. All the works connected to the development of new processes and products in the Goods and Garments technology, Footwear technology and leather technology are within the scope of this procedure. Development of product on request from any Goods and Garment unit, tanning unit / industry is not covered in this procedure but brought under consultancy. The PDU shall conduct a survey annually to assess the product trend nationally and globally every year. Here illustrated in the following view.



**Figure 5.4: Request to design new processes and develop new products services Capability**

### 3. Carrying Out Research & Product Development Service Capability

The third capability identified was carrying out research & product development. All the research and developmental works in the area of Goods and Garment, Footwear technology or leather technology are under the scope of this procedure. It is decided that a minimum of two research topics (in Goods and Garment area or Footwear technology area or leather technology area) shall be identified per year and research shall be carried out. However, the number of research entities shall be decided by Dir – GTD. Here we illustrated in the following view.



**Figure 5.5: carrying out Research and product development service Capability**

**4. Consultancy Services Capability**

Marketing Directorate works together with all stakeholders to render export facilitation support to the export oriented leather and leather products factories, such as, market search and match making,



### **5.4.3. Business Process Models with respect to Business Capability**

Now on the basis of the previous capability structure, assign expectations to ‘Service Points ‘that are controlled by the capability orchestrator. The services points allow business capability components to interact with their environment. In order to precisely describe the service, the research uses Activity Model or the business process models. Activity models are hierarchical in nature. They capture activities performed in the business process in a technology free and independent manner. This Activities Model actually describes the major process that is mentioned in the previous capability structure of ELIDI. In general, the major list of Business process of ELIDI are request to use the pilot plant facility services , request to design new processes and develop new products service, request research and development service, provide consultancy services, registration of profiles of industries , provide information service, and information control & preservation services.

#### **1. Request for Using the Pilot Plant Facility Service for Internal and External User**

Request to use the pilot plant facility service for internal and external users the workflow is shown in figure 5.5. The workflow process can be initiated by any employees of ELIDI from those who participate in the Goods and garment, footwear or Leather Technology Directorate or industries. If they need to use the pilot plant facility service, they have to request PGU and KMD. After the request to use the pilot plant facility is received, the respective Director duly approves and generates evidence of receipt and then PGU grants permission to carry out the work and assigns appropriate personnel and generates Job request with permission. Figure 5.7 and 5.8 illustrate the business process using Activities Model.

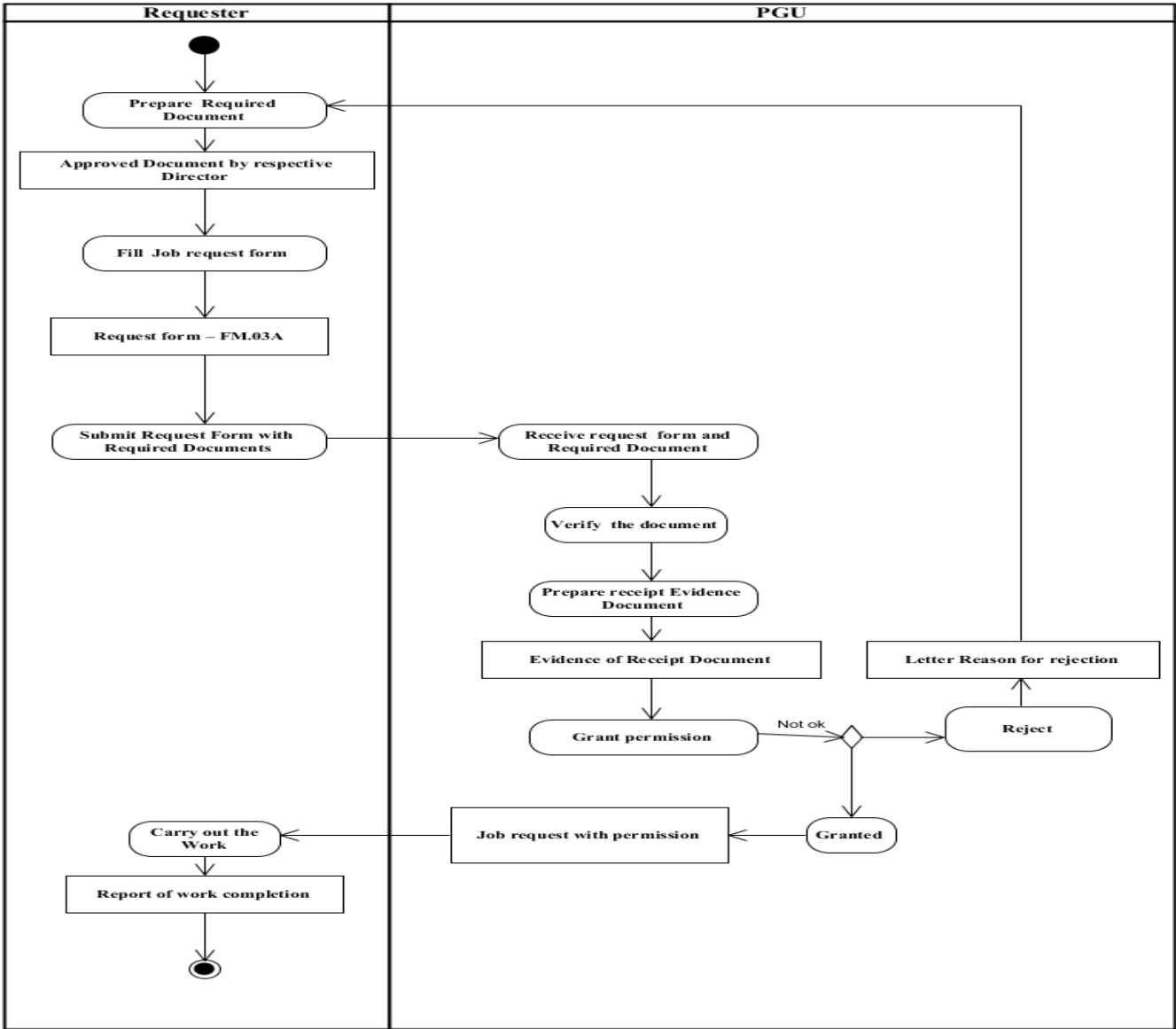
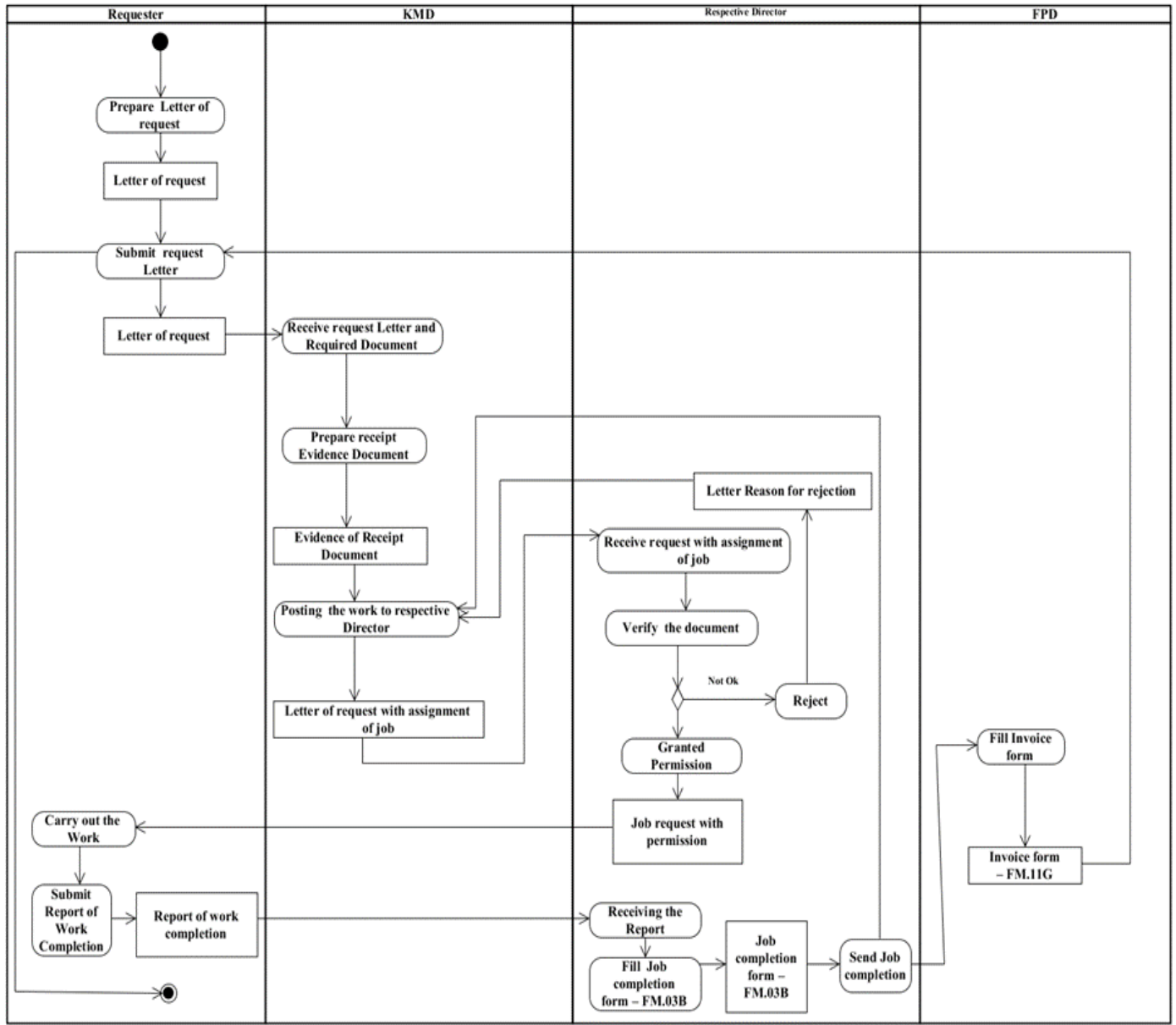


Figure 5.7: Request for using the Pilot Plant facility Service



**Figure 5.8: Request for using the Pilot Plant facility Service for External user**

## 2. Request to Design New Processes and Develop New Products Service

All the works connected to the development of new process and products in Footwear technology, Goods and garment Technology and Leather Technology Directorate are under the scope of this work flow. In this work follow, request for the development of product from any tanning unit or Goods and Garment unit / industry is not covered but brought under consultancy. All the activities that under take in this work follow are shown in figure 5.9

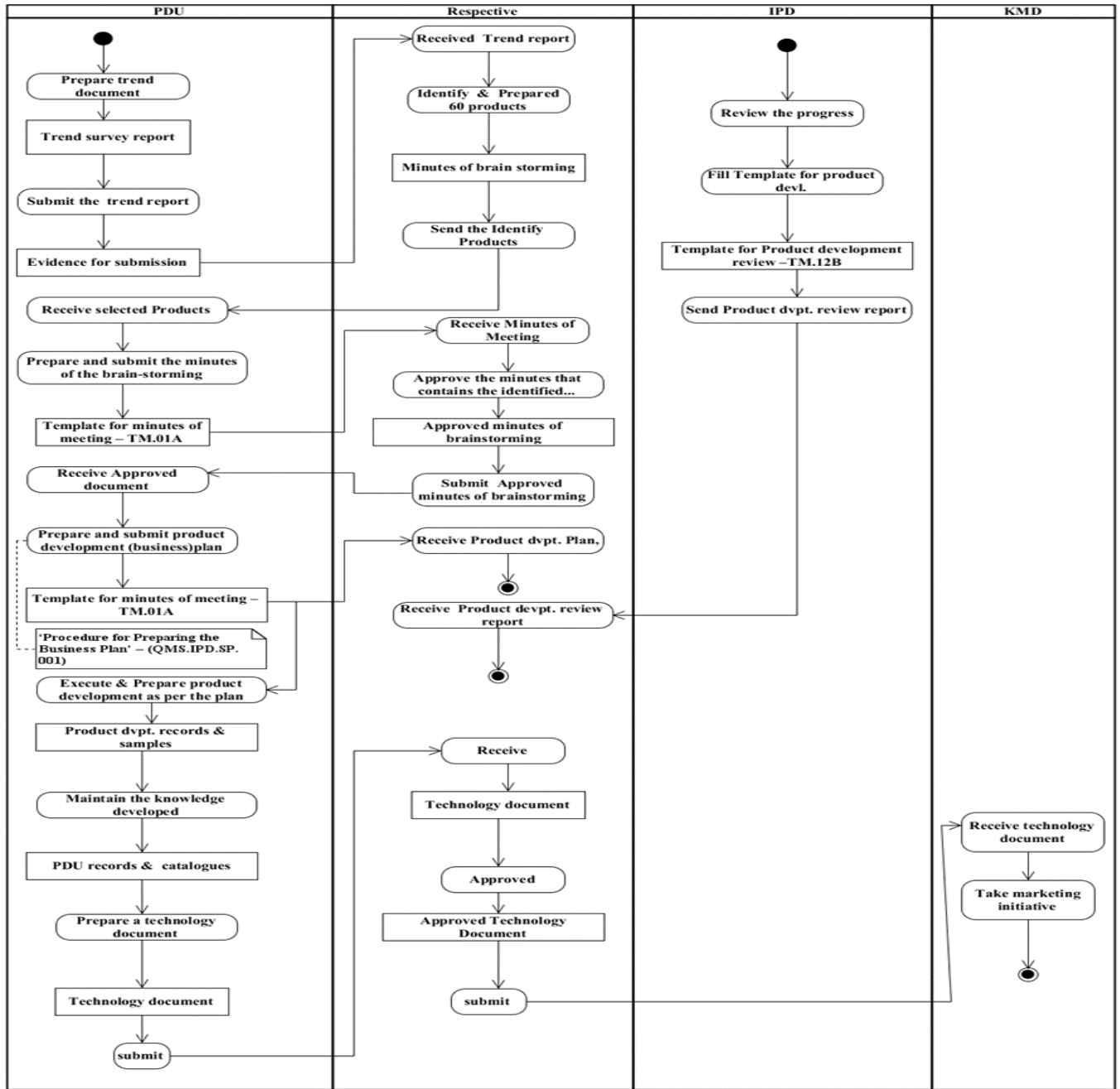


Figure 5.9: Design new processes and develop new products Service workflow

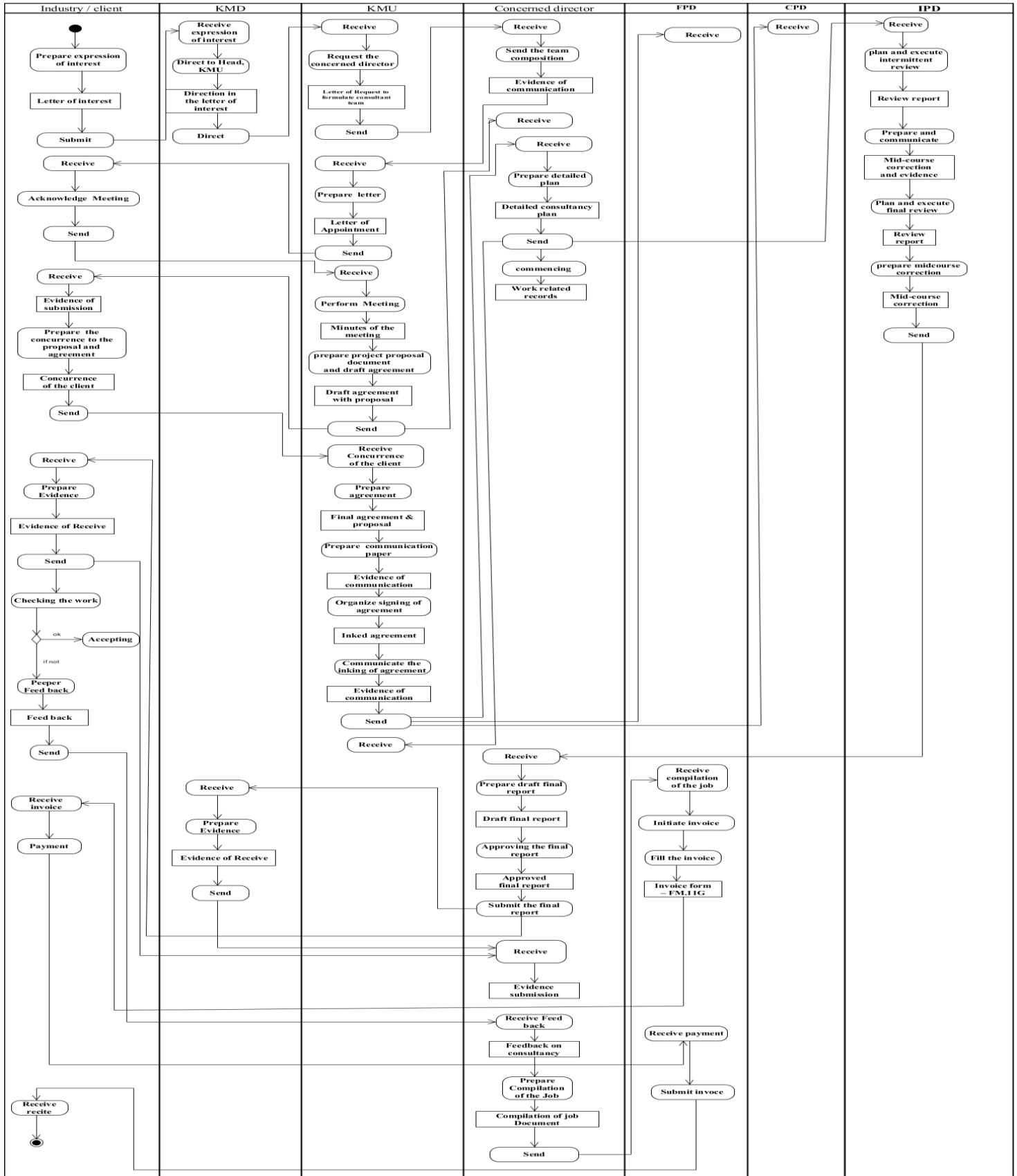


Figure 5.10: Providing consultancy service capability

BPM provides an abstraction level view for information exchange, and allows traceable data, shows information needed to support one or more business services, shows what data is consumed or produced by a business service, may also see the source of information, shows an initial representation of the information present within the architecture and therefore, forms a basis for the elaboration and refinement within Phase C (Information Architecture).

## **5.5. Phase C: The Information Systems Architecture**

The third phase in ADM cycle is Phase C, “Information Systems Architecture”. This phase is divided in Information-Architecture and Applications-Architecture. These architectures analyze functions requiring the support of ICT systems. The main objective of this thesis is to create an information-architecture. Thus, the main questions asked in this phase are: What the leather and leather product-information related elements required for ELIDI’s IA according to the requirements of the line directorates are and where can ELIDI find information to support the business.

### **5.5.1. Information Architecture**

The objective of the IA is to “define major types and sources of data necessary to support the business” [67]. Hence, the capabilities, elements and functions defined in section 5.4 (phase B, business architecture) are used.

Information architecture talks about the data used in the web based IA in the case of ELIDI and how those data are accessed. The architecture should assure that there is no redundancy in the data and databases to be interoperable with each other. This is the expression of the IA in terms of database being used in the Architecture. It is the design of the data stored in the information Architecture and their interrelationships.

### **5.5.2. Principle**

In phase A “Architecture Vision”, some general principles that govern the design of activities of IA are clarified. For the Information-Architecture, these specific principles should “provide guidance on the use and deployment of all ICT resources and assets across the enterprise”. Here, requirements imposed by the design and capabilities of ELIDI can be applied.

The conclusions drawn from the Business Architecture depicted that in order the Information-Architecture to cope with Information sharing, it should be flexible, expandable, should provide a connection between information and user transactions to conciliate some undesirable discrepancies. In

an unbundled environment, the design should be comprehensive for the relevant actors, facilitate interoperability, and promote information consistency. It should give more detailed information to the IA to enable to understand the sources of information and consumption, differentiate information for internal use and adequate information to be released to the actors of ELIDI and favor a cost-effective implementation.

### 5.5.3. Data Entity/Business Function matrix

In order to identify the key pieces of information the business needs, the researcher used the relationship between data entities and business functions within the enterprise. Therefore, Pilot Plan facility Master, Research & product development Master, Design of new processes and development of new product, Consultancy Management and Customer Master on the business function of ELIDI are assigned as Data entity. In the case of ELIDI, the information t used by those assigned Data entities is identified as a requirement. Thus, the concept of Data entity helps to focus on the information requirement of ELIDI and to identify and maintain a list of all the data used across the enterprise including the business function and the data components where data entities are held.

Based on the capabilities of ELIDI identified on the business Architecture, mapping of the Data Entity-Business Function relationship is presented below.

**Table 5.2: Data Entity / Business Function Matrix**

<b>Data Entity / Business Function Matrix</b>				
<b>BUSINESS FUNCTION (Y-AXIS) / DATA ENTITY(X-AXIS)</b>	<b>Data Entity</b>			
	Pilot plant Master	Research & development Master	Design new Process & develop New Product Master	Consultancy Master
Develop Production Capacity	Pilot plan service management  Owner of data entity ( or LTD, KUM LTD,GTD ) Function can Create, read, update and delete	ELIDI’s leather industry profile management  Owner – plan & information directorate		Consultancy service Management  Owner KMU

		Function can Create, read, update and delete customer master data		
Develop Production Capacity		Research & Product data management service  Owner – LTD, KUM LTD,GTD		
Develop Production Capacity			Product data management service  Owner – LTD, KUM LTD,GTD	

#### 5.5.4. Relevant information models for ELIDI

Admittedly, the industry currently uses many methodologies that define formal procedures specifying the process of gathering, analyzing IAs’ requirements and incorporating them into an IA design though the complexity is still very high. One characteristic of UML—also the one enables the widespread industry support that the language enjoys—is that it is a methodology-independent. UML is a modeling language for specifying, visualizing, constructing, and documenting the artifacts, rather than processes of software systems [6].

The design of the following object models is based on the above mentioned knowledge of activities performed by ELIDI. In general, the building of the contents of an information model must consider the scope, varying requirements from consumers to maximize the benefit and a specification. While in this Research, as in most of the researches, modeller focuses on those building blocks. In other words, the primary concern of the research is to design information model for ELIDI based on the identified information requirements.

There are three types of design approaches can be taken: a top- down design, a bottom-up design, and a mixed or inside-out design to develop the information model [87]. While this research uses the top-down design approach for information modeling. [87] As stated the most effective way is to take the

top-down design approach for modeling. Therefore, top-down design is chosen for this research. We use a top-down approach, reaching from a high level of abstraction—the application—down to the various technical levels. So based on this approach we create the requirement class model for each information model. For example “An ELIDI customer class is a means to describe the grouping of customers with similar characteristics for the purpose of requesting a pilot plan facilities. Any customer may be a member of zero or more customer classes.” And ELIDI’s Service classes are specific Service, the classes of Services, Service capability, Service responsibly and Service request.

As one of the possible scenarios in ELIDI Condition, the extension of Services class is visualized by the generalization between “classes of Services” class, “Service capability” class and “services property” (Figure 5.18). This structure shows the taxonomic relationship between a more general element (the parent—Service class) and a more specific element (the child class) that is fully consistent with the first element that adds additional information. The required information are classified into six components according to their functionalities. These are customer information, fulfillment information, service information, circular information, review information, and research and development evaluation information.

### 1. Customer Model

The Customer model contains the information about specific Customer, classes of Customer, and identification of Customer.

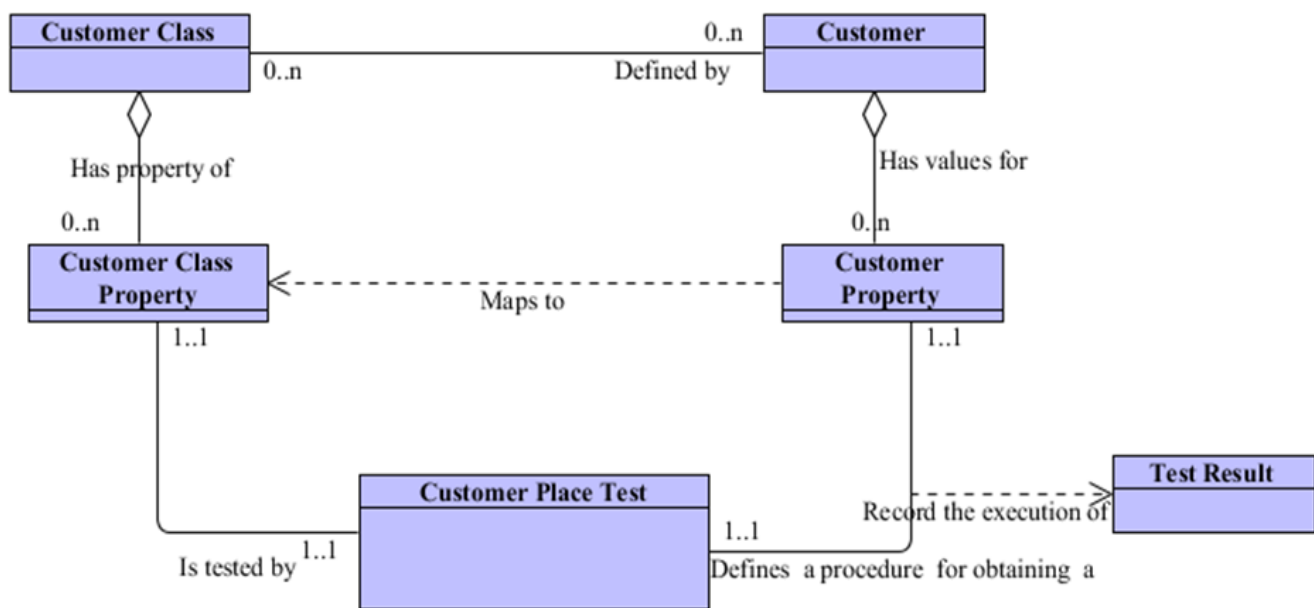


Figure 5.11: Customer Model

## 2. Fulfillment Model

Different information used in the business processes of ELIDI were identified. This model content information about the fulfillment class , job completion for head unit, material used in the service, directorate that participates in the service, job completion for the requester , job request for internal user , job request letter for external user, direction about the external user request, request \_team to formulate team ,and name of the team \_composition .

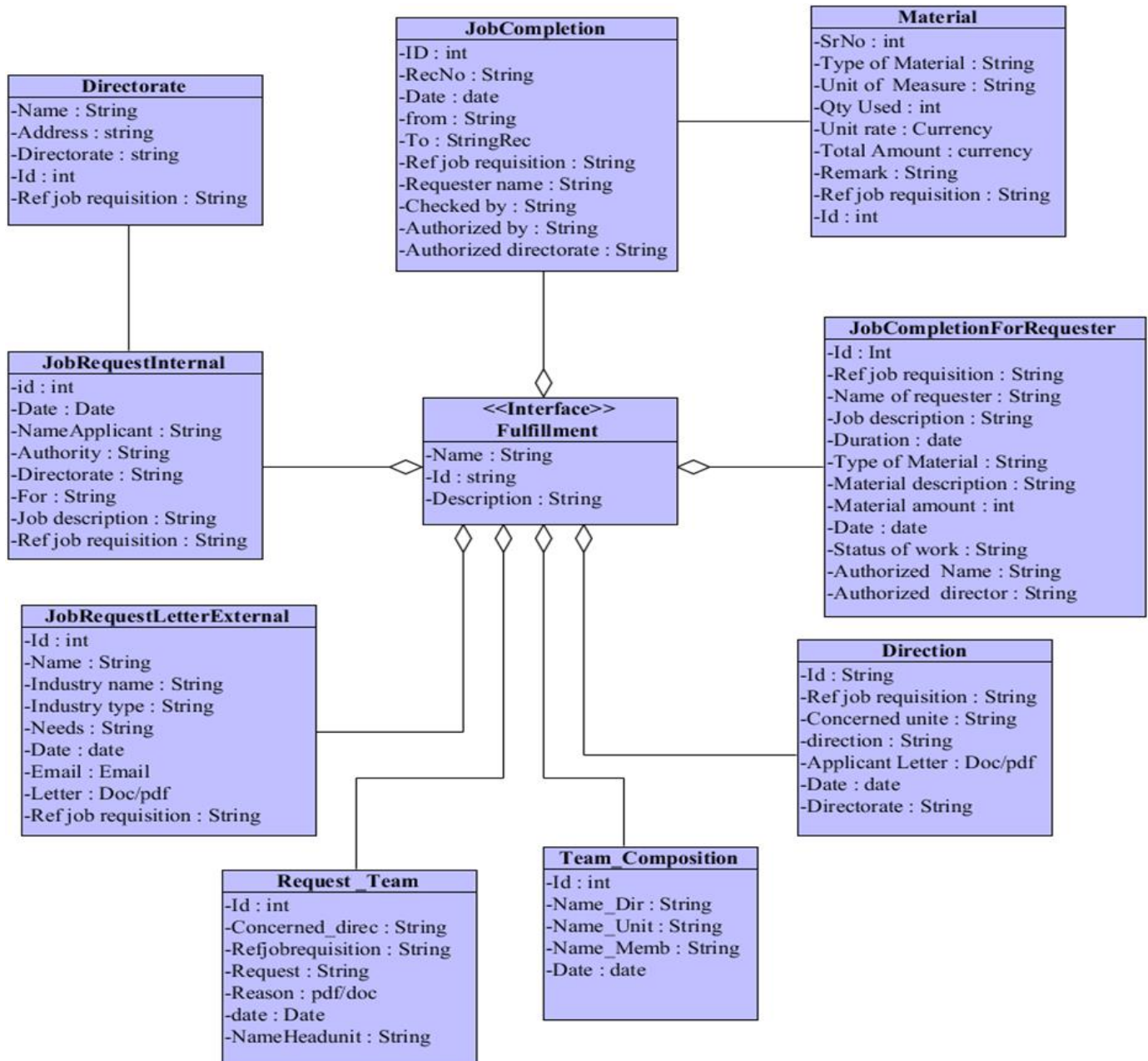


Figure 5.12: Fulfillment Model

### 3. Service Model

The Service model contains the information about specific Service, the classes of Services, Service capability, Service responsibly and Service request information associated with Service.

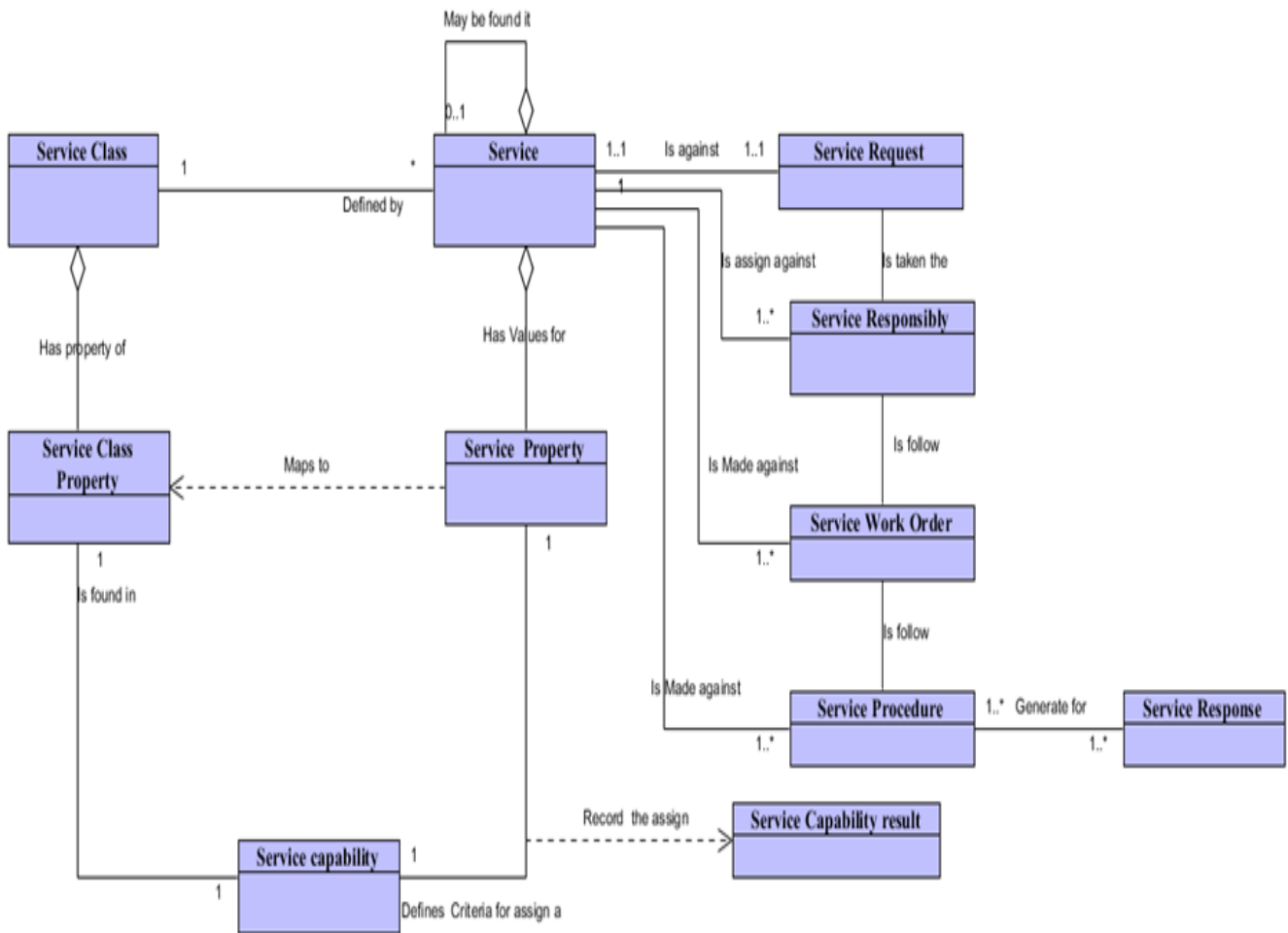


Figure 5.13: Service Model

#### 4. Circular Model

The Circular Model built for ELIDI defines the information about MeetingCircular, Attendance of Meeting, Minutes of Meeting, Action Points and information about classes of Meeting Circular. Class Meeting Circular information includes the ID, Name, and description of the Class.

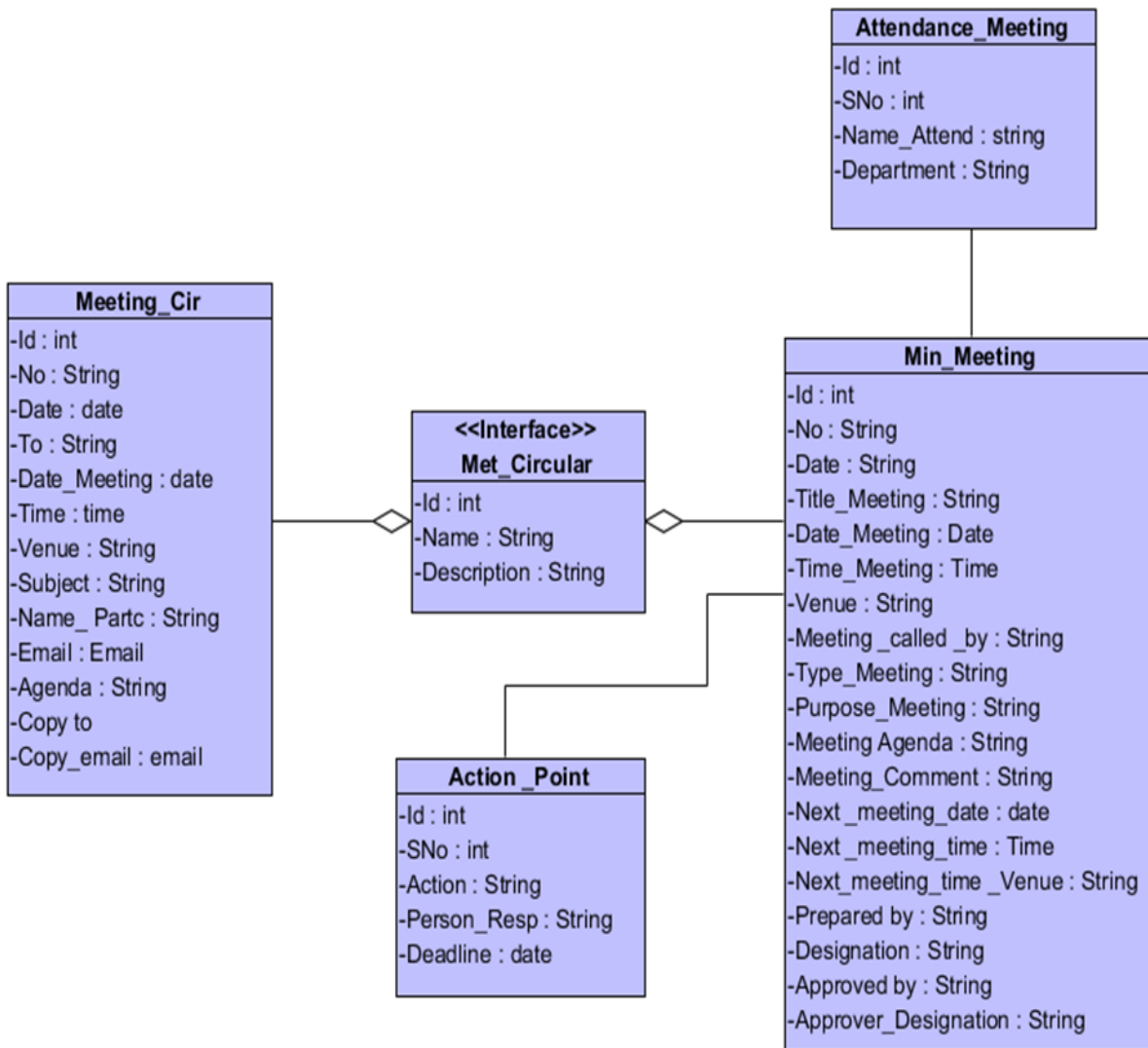


Figure 5.14: Circular Model

## 5. Review Model

The Review Model built for ELIDI defines the information about R&D Review, Product\_Review, and information about classes of Review. Class Review information includes the ID, Name, and description of the Class.

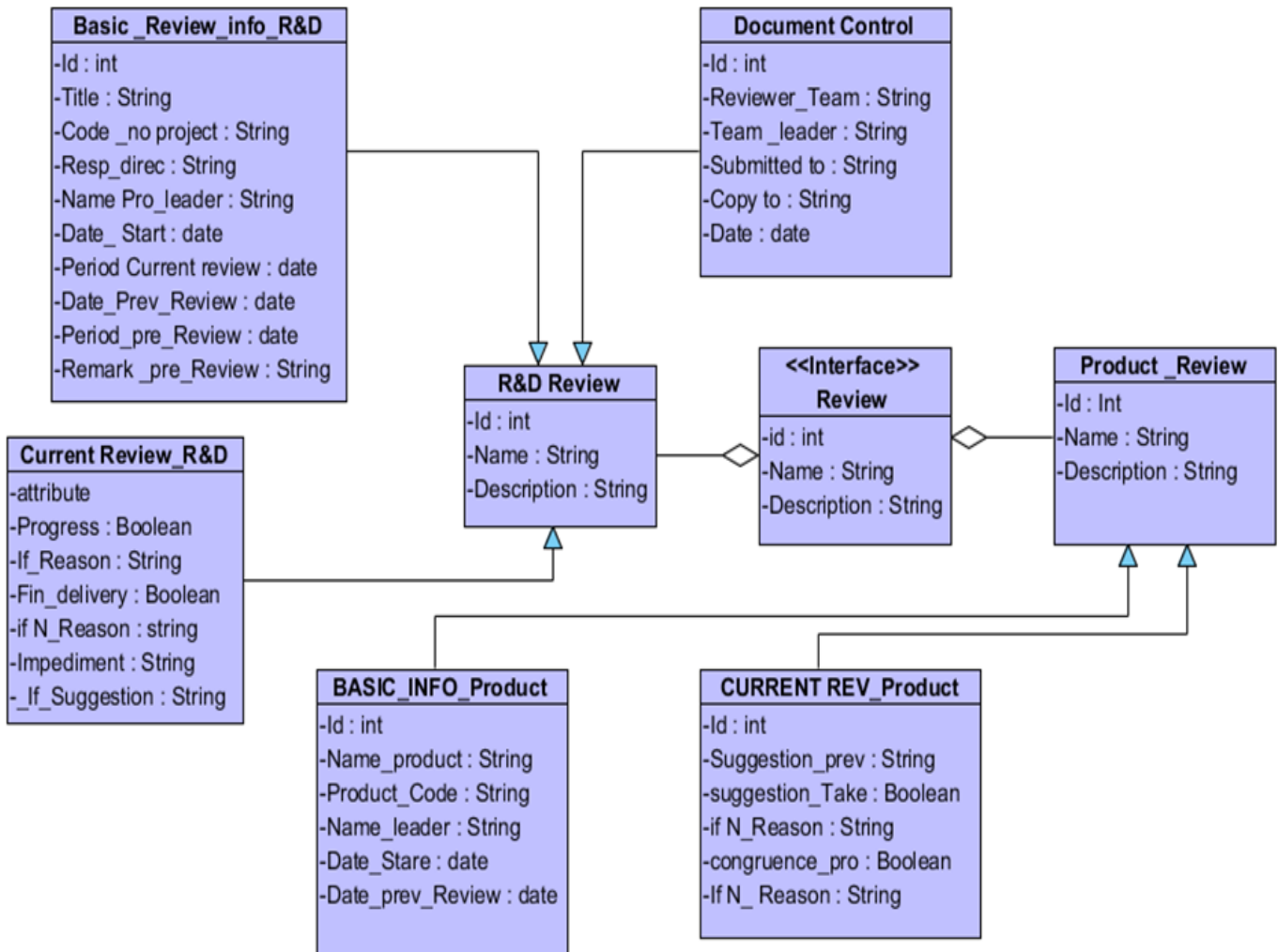


Figure 5.15: Review Model

## 6. Research and Development Evaluation Model (R & D)

When Research and Development service is undertaken in ELIDI, the R & D evaluation is furnished by the R & D team leader. R & D evaluation Model illustrates how R & D evaluation is structured in ELIDI. This model defines the Specific R&D evaluation, R&D evaluation definitions, and information

about classes of R&D evaluation. R&D evaluation information includes the part of R&D evaluation and the Class that participates on the R&D evaluation Model.

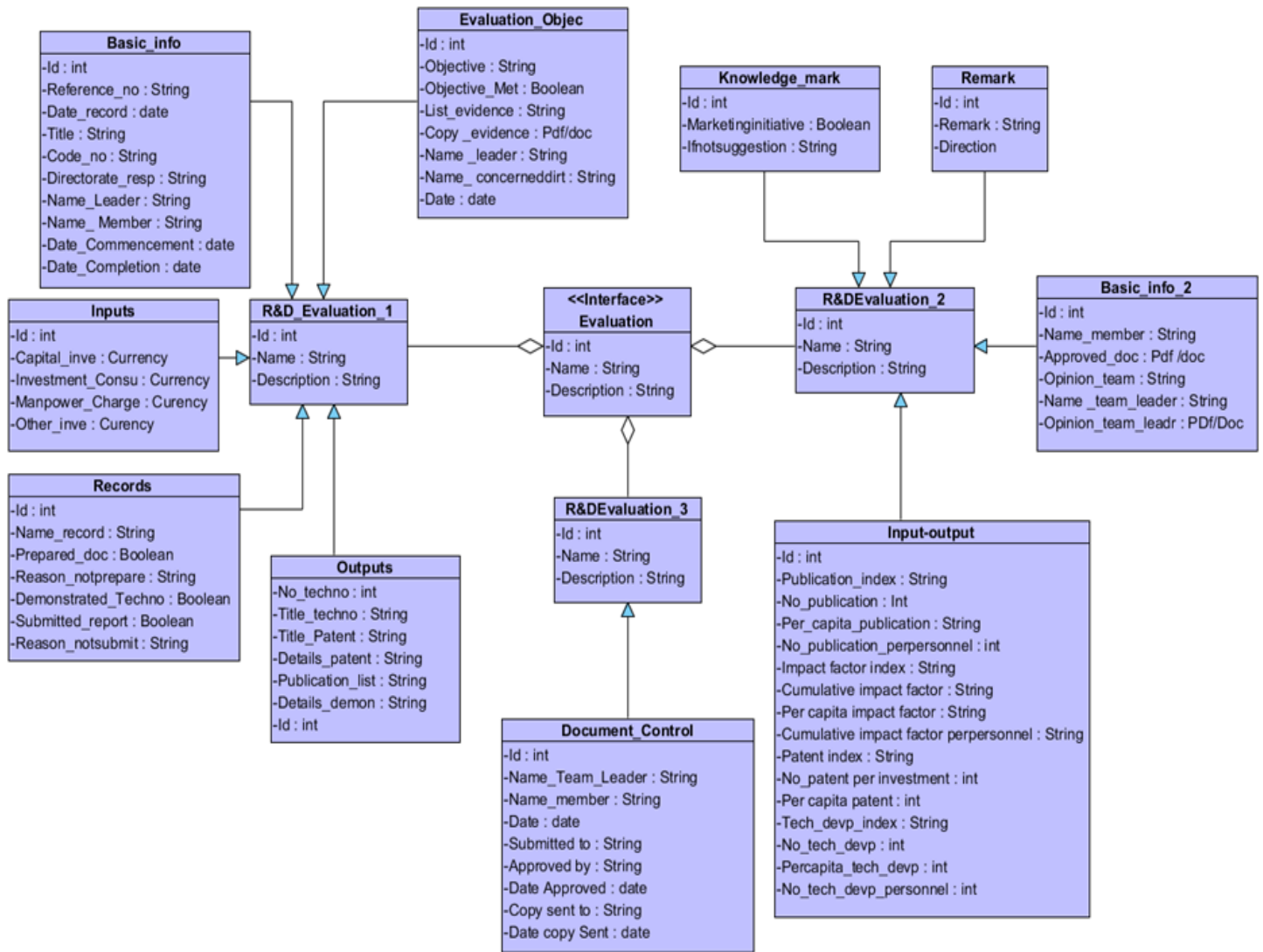


Figure 5.16: R & D Evaluation Model

## 7. Pilot Plan facility Request service Capability of ELIDI's

A Single service capability is defined as a logical grouping of personnel resources, responsible directorate, expert, and used material that is committed, result of the job and defined process for a specific time that is required to carry out a Pilot plan facility request step.

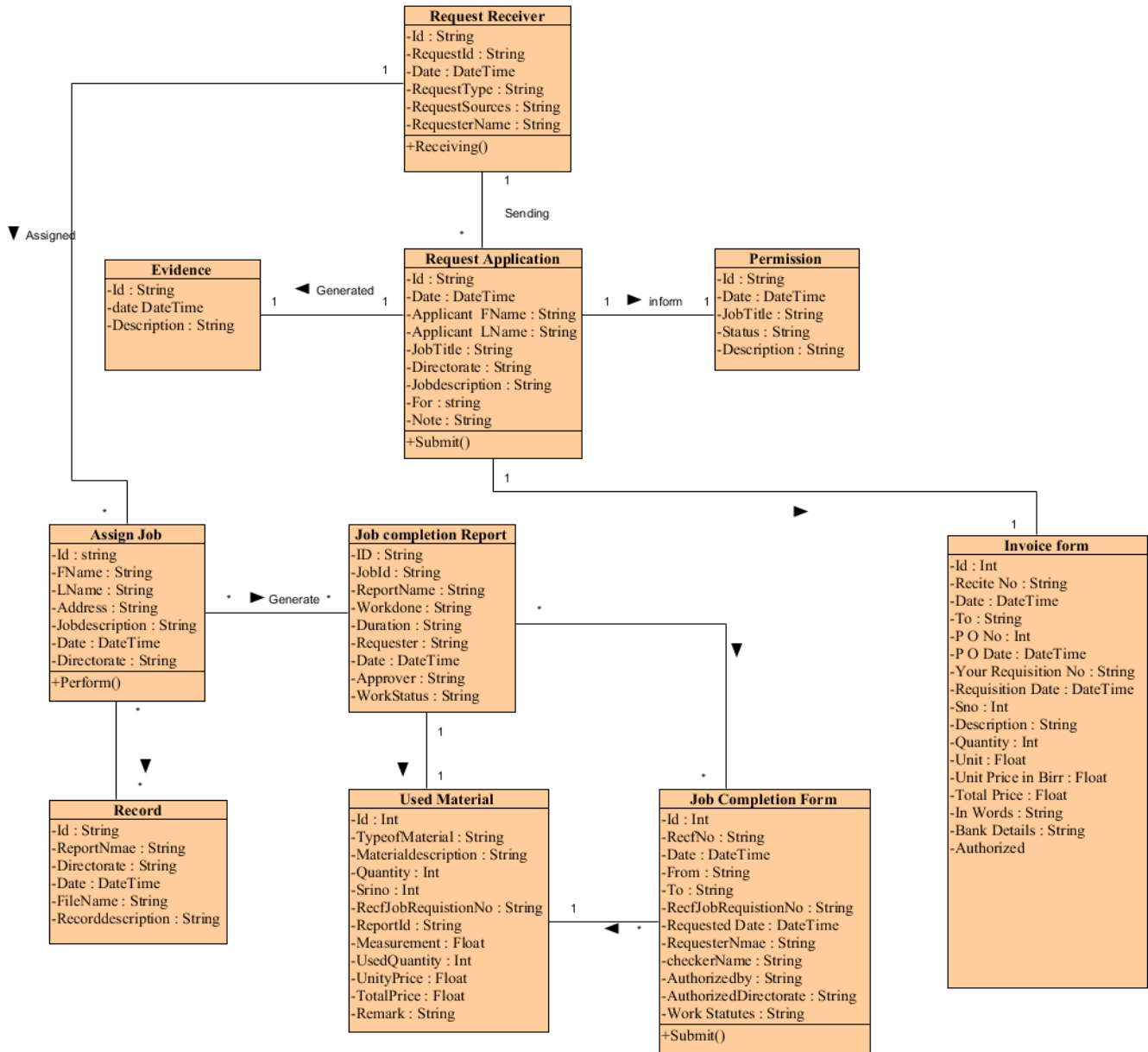


Figure 5.17: Pilot Plan facility Request Data Pilot Plan facility Request Logical data model

## 8. Web Based IA Model

The Web Based IA Model is the collection of information about all resources for Service of selected times. This is made up of information on the service, responsible directorate, service requester, review, evaluation and payment. It describes the type of service, the id of service and discription of the services. The service capability information contains the ‘vocabulary’ to provide service capability and to standardize service information.

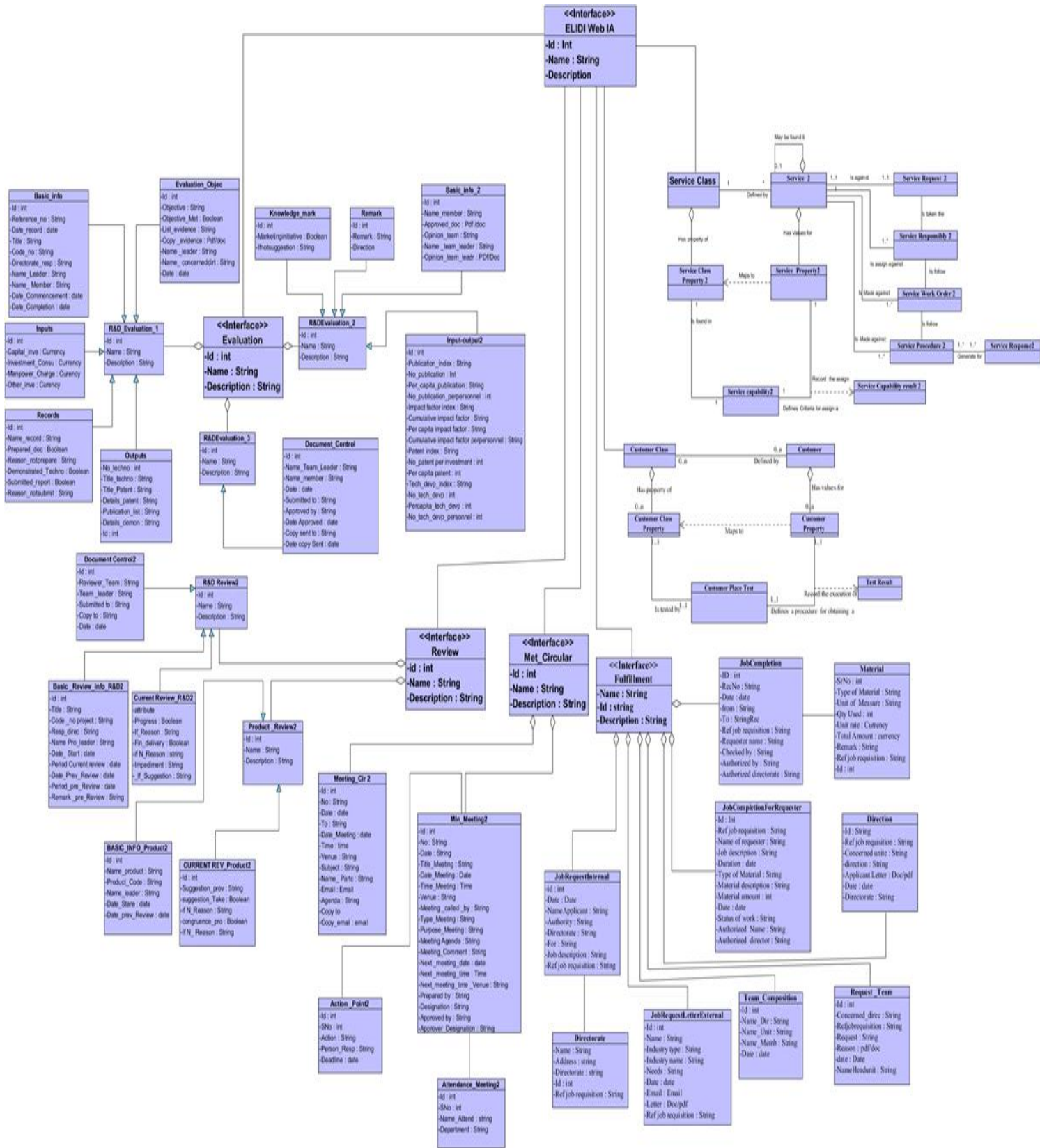


Figure 5.18: ELIDI Web based IA Model

### 5.5.5. Information Profile

In order to assess the information exchanged, static information contents required to be organized. Though information architecture describes the information exchanged, it is described in this element how business processes are used to extract important context characteristics. The business processes involve enterprise contextual factors that can be captured in the profile. This information profile will enable to assess information that is based on contextual factors. Information that is organized and classified according to the contextual factors, standardizes the structure and allows a single connected information pool, which enables to give feedback to the contextual content. From the Modeling Phase, visualizing and identifying the information exchange path is possible. Reports and documentation review allow to identify the key information elements that are being exchanged and shared, such as Customer information, service information, R & D Evaluation information, etc. In order to assess and measure the “right piece of information from the right source, in the right format, at the right place and at the right time”, the information in the context of what, when, who, where, and information format is profiled, shown in table 5.3 below.

**Table 5.3: information profile of ELIDI’s information.**

Where (Org)	Information Management		Develop Production Capacity		Develop Marketing Capacity	
	Fact and Result Type	Object	Fact and Result Type	Object	Fact and Result Type	Object
What (Info)	Customer Name, address , contact,	Customer	Services type, Services name, request name,	Services request	ID, Date, Applicant Name, Job title , directorate ,job description, For, Note	Consultancy service request
	Industry Name, Type, adders, Contact person, E-Mail, Mobile, year establishment,	Industry Profile	ID, Date, Applicant Name, Job title , directorate ,job description, For, Note	Pilot Plan facility Request service		

	Ownership type					
	Product type, Installed Production capacity /Day, Actual Production/Day. Remark , Other Services / Activities	Production Capacity	ID, Date, Applicant Name, Job title , directorate ,job description, For, Note	Research & product development request		
	Name association ,year of join ,	Industry Membership	Title & code no of the R&D project, Name of Leader ,date of previous review, Period of previous review, current review, Review team	Research and Development Evaluation		
	No of Female , no of Male , Total no	Industry Manpower				
	Type of raw materials, Semi process, Local Market (In %), Export Market (in %), Export Destination	Industry Market Area				

In general three stages are composed– Business Process Modeling enables connection of the enterprise level contextual factors to the data level, information model enables seen the taxonomic relationship between a more general element (the parent—Service class) and a more specific element, and Information Profiling facilitates structurally categorize information content.

## CHAPTER SIX: IMPLEMENTATION and EVALUATION

In this chapter, web based IA prototype for the ELIDI information sharing process information model is discussed. The chapter is organized into three sections from which the first provides list of tools and technologies utilized, the second section describes the user interface of the prototype and the last section Evaluation of the prototype.

### 6.1. Software Development Tools Used

In this research, different software development tools were used for each of the components as it is discussed in chapter three.

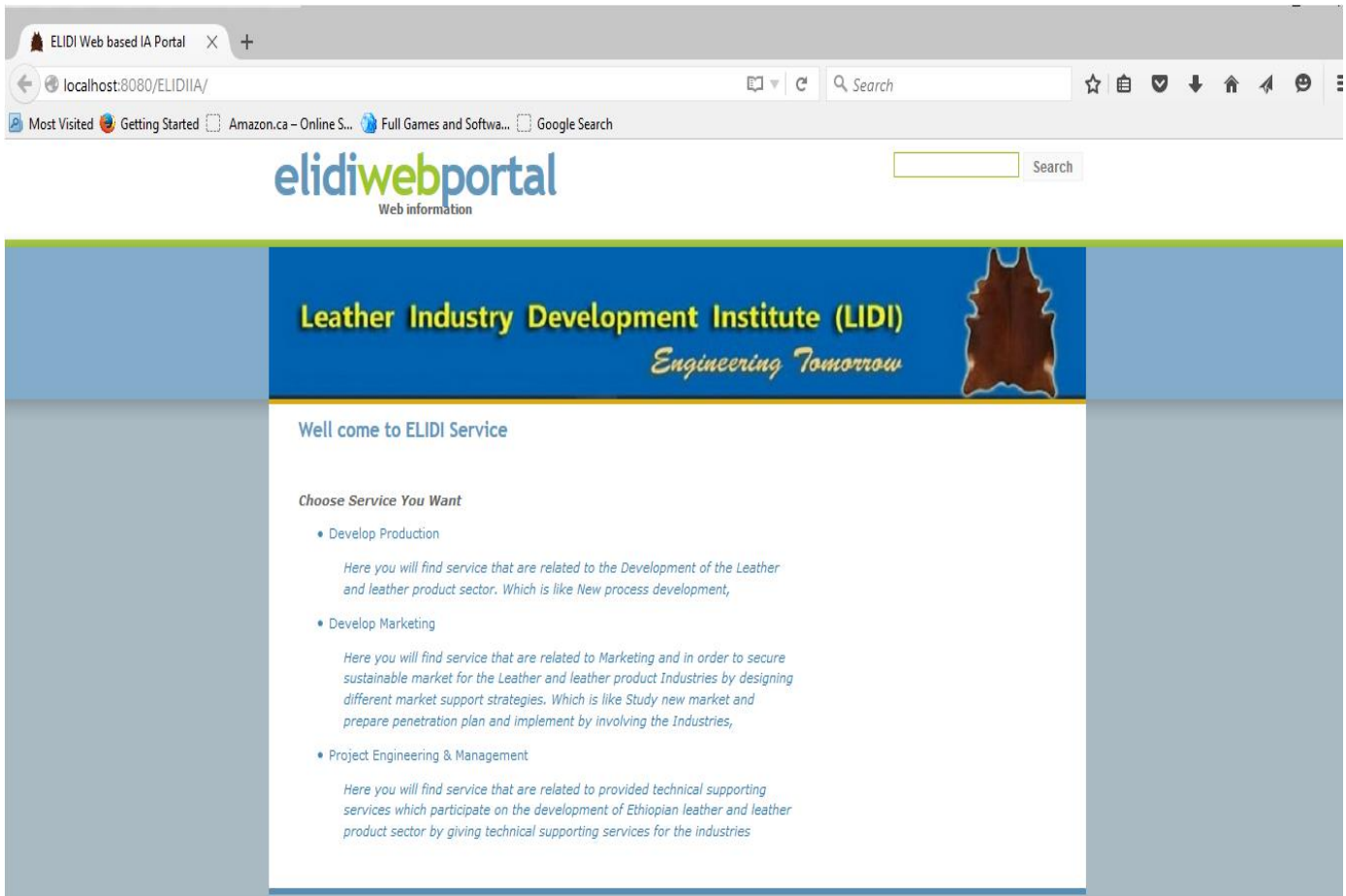
- The first component is the user interface that is basically web pages. The research used a graphic designing tool called NetBeans IDE 7.4 and code generating tool called and Java Server Face generate JSP code. The two tools help to design a good user interface of different components, such as forms, textbox, buttons, and hyperlinks to navigate from one page to another.
- For the business logics of the prototype, a programming language with Integrated Development Environment (IDE) tool called NetBeans IDE 7.4 is used. Java Servlet is one of the best programming languages in the development of web based application.
- Apache/2.4.7 is used as application server to deploy the business logic of the prototype. The application server receives the incoming service request from the end user or web browser and interprets the user request, interacts with database to retrieve data meet specific user request and sends the response back to the end user via web browser.

### 6.2. User Interface Description

The prototype has web user interface for different types of users and purposes. The overall structure of the prototype is shown in Figure 6.1 below. The interface will be accessible by appropriate users to carry out their duties. There are two types of users: administrator with access to all features and staff with access to limited features.

There are two primary pages to access the prototype: Login Page and Service catalogue page, and each of these can be accessed directly from the URL. When the staff accesses the prototype using its home page URL, it will present the content of the information. When the administrator tries to access the administrator page, the prototype will request him to log in. There are three pages in the prototype if

the administrator successfully logged in, and each of the pages can be accessed directly from the main menu.



**Figure 6.1: ELIDI Service View Page**

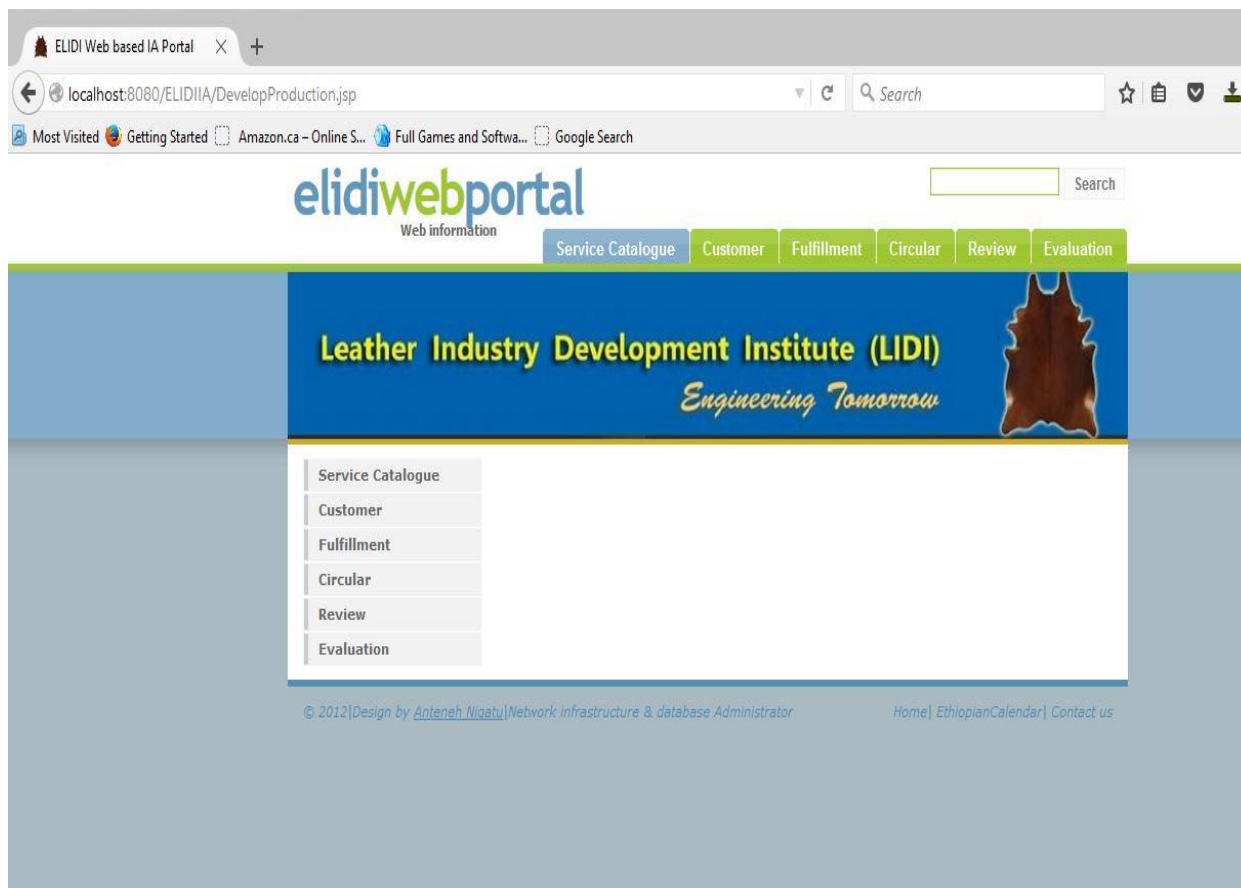
**View ELIDI Service Page:** This page enables the user to browse the Service Capability component using ELIDI capability categories and it allows to choose service as shown in Figure 6.2. The system presents list of service categories and their information components.

**Login Page:** As shown in Figure 6.3, login page is intended for system administrators that are authorized and given username and password to view, manage information and user.



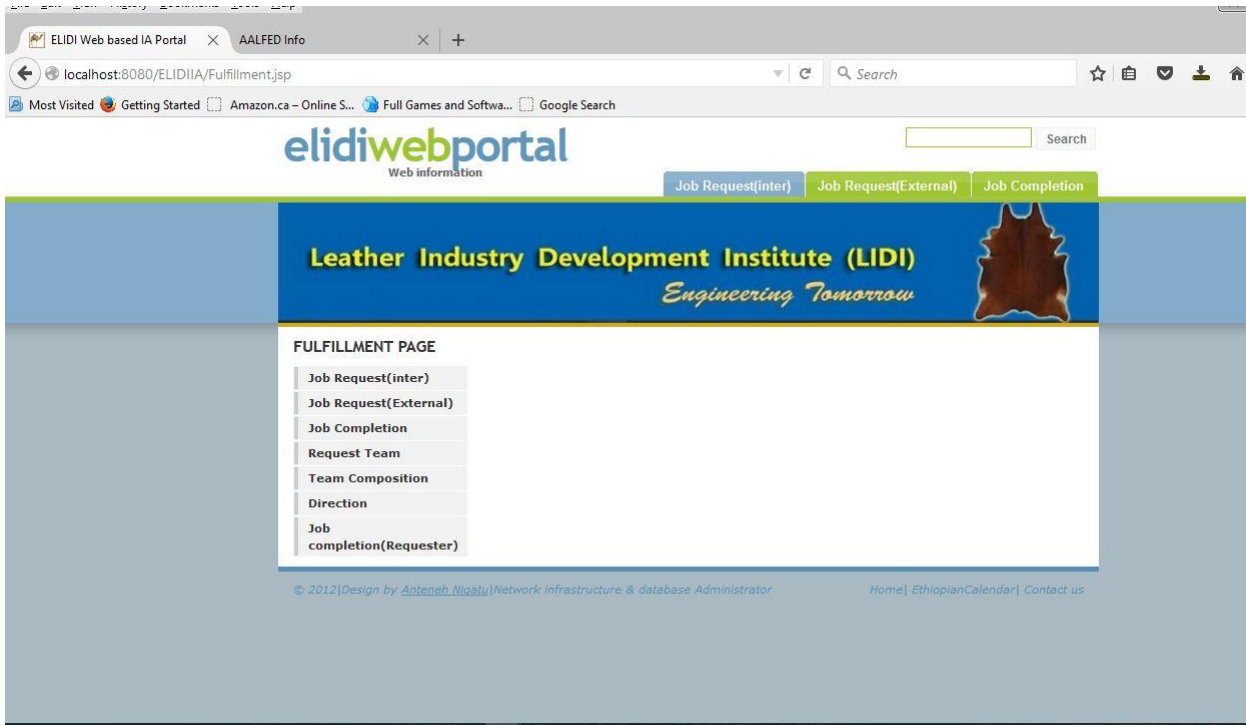
**Figure 6.2: Login Screen**

**Manage information Page:** this page as shown in the Figure 6.4 displays a flat Taxonomy structure of information categories. It presents a links to view new information categories and information components.



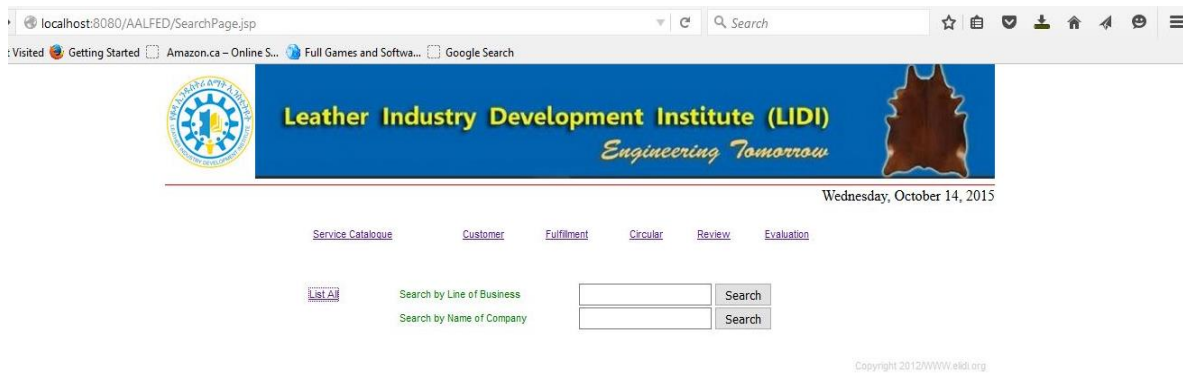
**Figure 6.3: Manage information Page**

**List of Fulfillment Page:** List of Fulfillment page contains a list of Fulfillment component for the selected Fulfillment categories. The list of Fulfillment page is shown in Figure 6.5.



**Figure 6.4: List of Fulfillment Page**

**List of Job Request Page:** This page presents the information part of the selected searched job component as shown in Figure 6.7. It also contains the link to the knowledge component it relates and its metadata.



**Figure 6.5: job Request Page**

**Job Request Page:** this page as shown in the Figure 6.9 presents a form that can allow user to request the needed job. The manage users page can also enables the user to create new users and edit and update an existing users.



[Service Catalogue](#)   [Customer](#)   [Fulfillment](#)   [Circular](#)   [Review](#)   [Evaluation](#)

Job Request Page

LIDI Code	<input type="text"/>	Name Requester	<input type="text"/>
Job Title	<input type="text"/>	Directorate	<input type="text"/>
Job Description	<input type="text"/>	For ( Email )	<input type="text"/>
POBox	<input type="text"/>	Job Give to	<input type="text"/>
Nature of Business	<input type="text"/>	Contact Person	<input type="text"/>
Remark	<input type="text"/>	Created By	<input type="text"/>
Created On (yyyy/mm/dd)	<input type="text"/>		

Figure 6.6: Users job request Page

**User Part of information Component Page:** This page presents the expertise part of the selected information component as depicted in Figure 6.8.

Description This expertise contains tacit knowledge identified from experienced facevat officers.

Related Knowledge Component [Requirements](#)

Properties

- Identify Required documents
- Identifying declaration date
- Confirm the presence all required documents
- Confirm Document Originality
- Issue Customs release
- Using ASYCUIDA
- Using Facevet

Owner Import Customs Clearance Team

Type Tacit

Importance Operational

Figure 6.7: User Part of information Component Page

### 6.3. Evaluating the Web based IA

The constructed web based IA is finally evaluated by experts. These experts are web master, database administrators, information expert, production development unit leader, IT team leader, leather expert, garment technology experts and marketing manager. The evaluations tries to identify the extent of users' acceptance of the web based IA which is constructed in this study. The points raised to evaluate the created artifacts are the following.

- Web based IA is helping visitors to quickly find relevant information on the web.
- The Constructed information content and ELIDI information requirements are the same.
- Web based IA is useful for user satisfaction.
- Web based IA enables to improve website design and usability.
- Web based IA enables to improve service delivering system.
- Web based IA increases information sharing by recommending pages related to the ones being considered.
- Web based IA is adaptive and easy to use.

Summary of evaluation of experts' acceptance testing result is presented in table 6.1 below.

**Table 6.1: Evaluation of Web based IA**

Evaluation of Web based IA		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	Is Web based IA helping visitors to quickly find relevant information on the web?	4	1	2	1	
2	Are the Constructed information content and ELIDI information requirement the same?	5	1	2		
3	Is Web based IA useful for user satisfaction?	7	1			
4	Does Web based IA enable to improve website design and usability?	8				
5	Does Web based IA enable to improve service delivering system?	8				

<b>Evaluation of Web based IA</b>		<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
6	Does Web based IA increase information sharing by recommending pages related to the ones being considered?	7	1			
7	Is Web based IA adaptive and easy to use?	6	1	1		
8	Does Web based IA enable information sharing between ELIDI Employee?	3	3	1	1	
<b>Sum</b>		<b>48</b>	<b>8</b>	<b>6</b>	<b>2</b>	
<b>Percentage</b>		<b>75%</b>	<b>12.5%</b>	<b>9.4%</b>	<b>3.25%</b>	

According to the evaluation result obtained (see table 6.1 above), 87.5% of the experts believe that the web based IA is useful. 9.4% and 3.25% of the experts are neutral and disagree respectively. This clearly shows that the created web based IA improves information sharing practice, helps users to quickly find relevant information on the web, increases service delivery system of ELIDI etc..

## CHAPTER SEVEN: CONCLUSION AND RECOMMENDATION

### 7.1. Introduction

This chapter discuss the conclusions drawn from the research and the recommendations for future research.

#### 7.1.1. Conclusion

The main objective of this research is to design Web Based Information Architecture for ELIDI to promote information sharing among the employees of ELIDI and with the leather industries. In order to achieve this objective, design science research, case study and TOGAF are employed in this research. The research was conducted at Ethiopian Leather Industry Development Institute (ELIDI).

Interviews were conducted with the Domain Expert respondents who were identified according to the actors defined by TOGAF, the framework which has been followed to conduct this research. The interview identified the information requirements of the Directorates of the Footwear Technology, Goods and Garment Technology and Leather Technology. On the basis of the requirements, Information architecture was designed and Architecture Vision and business architecture were analysed. The business architecture showed the business capabilities of ELIDI, the major business process of ELIDI and the information used by each business process. The current information sharing practice of ELIDI is found out to be manual. Hence, Web Based IA is designed to enable service users to access information through web system.

Conclusions are presented according to the research objectives and discussed in detail on the basis of research questions that stated in chapter one. Therefore, three sub-objectives are defined to achieve the research objective. Thus, the result came up with following conclusions for each research question as discussed below.

**1<sup>st</sup> Specific-objective:** To identify the information sharing practices of ELIDI.

##### *1. What are the key information sharing practices in ELIDI?*

The interviews conducted with the Domain Expert respondents and the analysis of ELIDI's services capability showed that the current business process of ELIDI, information sharing practice and the way of service delivery method to customers is through documents, seminars, training, etc. Thus, the problems identified in the current situation of ELIDI are:-

1. The interview depicted that the services capabilities of ELIDI is delivered based on traditional system where data redundancy is common.
2. From the interview we understood that ELIDI is collecting information in bits and pieces from different resources. Required information is stored in different applications and owned by different members in the supply chain. Required information for ELIDI's services are not integrating into single view. So decision makers collecting pieces of information and then making decisions on the basis of their experience. Quality of decision depends on the information available at the spot.
3. From the observation and interview we identified information exchange between directorates are manually there is no web based information sharing - since there is no web based information sharing facility between directorates and the activities are done manually it creates an information gap with in different sections of the directorate and with other directorates also.
4. Accessing different resources: - it is very difficult to access resources easily i.e. they have a manual search mechanism. This is time taking in case they need to see the old original document.
5. Preparing different Formats: - Since there is a delay in exchanging reports as these passes through many levels, they are vulnerable to damage and quality problems which make it hard to prepare Report. It does take time to collect original documents and compile them for formatted report.
6. Resource usage like paper, time etc.: - economically the directorates waste most of its budget in purchasing different papers and forms. So the costs are too high. Since the organization is a government organization, this can be taken as an obstacle to their success.
7. Security and control problem: - currently All directorates system has little security. ELIDI employees do not have a clear privilege to access information. So there may be conflict in which area the error has occurred.
8. Since the way to communicate between different directorates are manual, which results manual data exchange or by using external drivers it is big problem and it would be cause for data damage .

All these uncertainties are due to unavailability of right information. We identified important issues that cause for all the above problem by analyzed the ELIDI's business capabilities and business process and we identified the requirement information for ELIDI's services to deliver efficiently and

effectively. Then we tried to find out who own this information in the services and either each directorates have permission to access this information or not.

**2<sup>nd</sup> sub-objective:** To identify the information structure of ELIDI domain focusing on leather and leather products services.

*2. What are the leather and leather product-information contents required in ELIDI's IA according to ELIDI's line directorates' requirement?*

In order to find out the requirement contents of the leather and leather product-information in the case of ELIDI's we were focused on ELIDI's service capabilities based on Develop production capacity capability and we created the functional decomposition diagram and presented the services capabilities of ELIDI that are relevant to the consideration of an architecture while we examined services capabilities of ELIDI from a functional perspective, it is possible to quickly develop models of what the organization does without being dragged into extended debate on how the organization does it. Thus we showed the business process of ELIDI and from the business process we identified the required information for the ELIDI's IA.

**3<sup>rd</sup> Sub-objective: To design a web based information architecture for ELIDI.**

*3. How we design suitable IA for ELIDI?*

The base for the web based IA is the requirements got from the respondents and business architecture analysis. This follows the TOGAF. The requirements identified from the interview with respondents from ELIDI's domain expert and are used to design the architecture. Microsoft Visio/UML was used to visualize the architecture which is clearly discussed in chapter three. The business architecture shows different services capabilities that provided by ELIDI and different business process respective to capabilities. Information architecture shows how the users access to the service.

### **7.1.2. Depiction of Information Used in ELIDI**

In an IA for ELIDI is important to clearly represent six main aspects:

- Information flows: Movement of information from a generating entity to a receiving entity;
- Information sources: Internal process or directorate that generate data;
- Type of information: The characteristics of information to be exchanged.

Regarding the type of information, in general we can classify information in six categories: information related to the customer (i.e. information about service user ), information related to

Fulfillment (i.e. job completion, Job request, Directorate and Material), information related to **Service** (i.e. information on specific service, service capability, service responsibility and service request information), information related to Circular (i.e. Meeting Circular, Attendance of Meeting, Minutes of Meeting, Action Points and information about classes of Meeting Circular), information related to Review (i.e. information about R&D Review, Product \_Review, and information about classes of Review), and information related to the Research and Development Evaluation (i.e. Specific R&D evaluation, R&D evaluation definitions, and information about classes of R&D evaluation).

## 7.2. Recommendation

On the basis of ELIDI's requirement, the web based IA and the supportive information classification and information model has been developed. Still all the issues have not been addressed in this research. Thus the following research has been recommended.

1. On the basis of ELIDI's requirement, the web based IA and the supportive information classification and information architecture has been developed. The proposed IA will solve the problems mentioned in the current system if the Institutes implements the proposed architecture.
2. It is also necessary to provide training for employees working in Plan and Information directorate to successfully implement the proposed architecture.
3. Architectural frameworks provide valuable orientation for the development of an IA. However, all the recommended steps can be applied to the ELIDI case. Best practices taken from experiences in similar industries (i.e. network infrastructures) would provide additional valuable insights for the ELIDI system, so further research on these practices is recommended.
4. The architecture proposed by this research is a conceptual architecture. So, there is lot more detail information necessary to adopt this kind of architecture. Like for example, what could be the detail technological specifications like capacity of servers, configuration of computers, speed of connectivity according to the access, what could be the financial requirements and so on. Thus, it is recommended to do the study on in depth analysis of requirements on the basis of the designed architecture.
5. The final recommendation is to use the IA to design ways of improving and optimizing ICT resources and to standardize the information exchange. Standardization will help on reducing the transaction costs produced by unbundling. For instance, if huge amount of information need to be exchanged

with a specific actor, a common database could simplify the transactions; if large amount of information needs to be analyzed but not stored, specific processing techniques can be adopted, etc.

### **7.3. Future Research**

Still all the issues have not been addressed in this research. Thus, the above recommended research in the case of ELIDI information sharing for the future studies has been recommended. It is also necessary to undertake research by implementing the proposed architecture and evaluate its effectiveness in the day to day information sharing activities among the leather industries.

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## APPENDIX I: THE ADM DEVELOPMENT CYCLE

In TOGAF (TOGAF 2009), each phase of the ADM development cycle is described as follows:

The Preliminary Phase describes the preparation and initiation activities required to prepare to meet the business directive for new enterprise architecture, including the definition of an Organization-Specific Architecture framework and the definition of principles.

- **Phase A: Architecture Vision** describes the initial phase of an architecture development cycle. It includes information about defining the scope, identifying the stakeholders, creating the Architecture Vision, and obtaining approvals.
- **Phase B: Business Architecture** describes the development of a Business Architecture to support an agreed Architecture Vision.
- **Phase C: Information Systems Architectures** describes the development of Information Systems Architectures for an architecture project, including the development of Data and Application Architectures.
- **Phase D: Technology Architecture** describes the development of the technology Architecture for an architecture project.
- **Phase E: Opportunities & Solutions** conducts initial implementation planning and the identification of delivery vehicles for the architecture defined in the previous phases.
- **Phase F: Migration Planning** addresses the formulation of a set of detailed sequence of transition architectures with a supporting Implementation and Migration Plan.
- **Phase G: Implementation Governance** provides an architectural oversight of the implementation.
- **Phase H: Architecture Change Management** establishes procedures for managing change to the new architecture.
- **Requirements Management** examines the process of managing architecture requirements throughout the ADM.

## APPENDIX II: LETTER OF COOPERATION

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Addis Ababa University  
College of Natural Sciences  
School of Information Science

Ref: SIS/57/15/07

Date:- February 06, 2015

**To:** Ethiopian Leather Industry Development Institute  
Addis Ababa

**Subject:** Request for Cooperation


Dear Sir / Madam

Student Anteneh Nigatu (ID:GSE/1013/05) is a graduate student in the Department of Information Science, Addis Ababa University.

He is currently conducting research on Web based information architecture for information sharing and integration:- The Case of Ethiopian Leather Industry Development Institute.

This is therefore, to request for your assistance in providing data /information required for his research.

With regards

  
Solomon Teferra (PhD)  
Head, School of Information Science



☒: 1176 ☎:251-(11)-122- 91-91 ☎:251- (11)-122- 92-00 FAX: 251-(11)-123-97-68

## APPENDIX III: INTERVIEW QUESTIONS

### A. Interview questions for (Footwear Technology, Goods and Garment Technology and Leather Technology Directorate)

#### Section I: Respondent Information

1. Respondent's name: \_\_\_\_\_
2. Position: \_\_\_\_\_
3. Expertise: \_\_\_\_\_
4. Years of experience in ELIDI: \_\_\_\_\_
5. Directorate \_\_\_\_\_ Title \_\_\_\_\_
6. How long you have been working in ELIDI in this position? \_\_\_\_\_

#### Section II: Questions regarding information sharing

1. What is your role in the information sharing processes? \_\_\_\_\_
  - a. Do you collect information for service delivery purpose? \_\_\_\_\_
  - b. If yes, what kind of information do you collect?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - c. From whom? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - d. How do you communicate with other directorates? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - e. Do you have information about the other organizations that participate in the leather sector \_\_\_\_\_? If yes, what kind of information? If no, why?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - f. Where do you store the collected information? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

g. Do you share information with other organizations? \_\_\_\_\_ if yes, how do you Share?

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2. What is the communication format that you use to share data with the leather sector?

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3. What type of information is considered to be crucial in the ELIDI?

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4. What information provided by your directorate is useful for the leather sector?

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5. Does the Directorate know what information its users need to access? \_\_\_\_\_ If yes, what are they?

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6. Is it known the information ELIDI needs to create and capture in the first place? \_\_\_\_\_ If yes, what are they?

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7. What do you think should be adapted in the future to share information?

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8. What are the drawbacks of the current information sharing system?

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9. Is the information stored digital or in paper? \_\_\_\_\_

10. If it is digital, is that online system? \_\_\_\_\_ if yes, how do you manage the system?

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11. If it is in paper, how do you update and manage?

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12. Is information always stored in corporate rather than personal spaces? Yes / no \_\_\_\_\_

13. Are the information requirements associated with the workflow of the process in the units in identified the form of standards, handbooks, procedures? Yes / no \_\_\_\_\_

14. Are technologies, skills and infrastructure for storage, maintenance processing and retrieval of information available? Yes / no \_\_\_\_\_

15. What do you say about providing information to the leather sector online?

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**Section III: Organization's opinion on access to information**

1. What do you say about providing information to the leather sector online?

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2. Is there any policy which allows easy access to information to leather sector?

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3. Is there any difficulty in linking and sharing data among ELIDI employees?

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4. What will be the benefit if centralized database is created, linked and shared with each other?

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5. Should there be any access restriction to some of the information----for the privacy of the data? It means privacy of the data.

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6. Anything else you want to add please?

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**Section IV: ELIDI's responsibility in service delivery**

1. What are the main functions/ Directorates of ELIDI?

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2. What are the major functions of ELIDI?

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3. What are the services your Directorate provide? \_\_\_\_\_

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4. Do you have any role in the service delivery of ELIDI?

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5. How are the services delivered to the user (process for service delivery)?

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a. Are there any systems that support the operation of the service delivery?

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b. What applications /devices/systems are used to deliver the service?

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6. What is the information you require to provide those services?

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7. How do you get that information?

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8. Are there any difficulties to get information?

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9. How do you minimize those difficulties?

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10. Will it be beneficial if web based IA is implemented for ELIDI services?

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**B. Interview questions for planning and information directorate at ELIDI**

**Section I: Respondent Information**

1. Respondent's name: \_\_\_\_\_
2. Years of experience in ELIDI: \_\_\_\_\_
3. Position: \_\_\_\_\_
4. How long you have been working in ELIDI in this position? \_\_\_\_\_

**Section II: About ELIDI's Data and Information**

1. What do you say about the responsibility of your organization in information sharing for the sector?

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2. What is the main objective of your organization?

3. Do you have any information sharing system? \_\_\_\_\_ [ if yes go to 8 , if no go to 9 ]

4. What is the security system of the existing information sharing method?

5. Can you explain about the architectural concept of IA?

6. Is there any IA in ELIDI? \_\_\_\_\_if yes

a. Is the existing IA of ELIDI enough to support information sharing? \_\_\_\_\_if no

b. What are the problems in this IA?

7. What should be done to come over the problems? Are there any future plans in this sector?

8. Are there any laws about data bank/storing data/integrated data center?

9. Is there any electronic information sharing way in ELIDI?

10. What is your opinion about web based IA for information sharing? Does it support ELIDI to meet its objectives?

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11. Do you think it is beneficial if web based IA is implemented for ELIDI services? \_\_\_\_\_

12. Is there any law/act on data security?

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13. Who should be liable for the data produced?

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14. What kind of services do you provide to in relation to leather?

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15. Do you have any role in the service delivery of ELIDI? \_\_\_\_\_ if yes, how do you provide the service to customers?

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## APPENDIX IV: FIELD STUDY PROTOCOL (OBSERVATION)

Name of the observer: \_\_\_\_\_

Case location: \_\_\_\_\_

Observed Directorate: \_\_\_\_\_

Number of participants observed: \_\_\_\_\_

<b>General</b>	<b>Description</b>
Information management roles, tasks and responsibilities	(describe the roles, tasks and responsibilities regarding information management)
Information Sharing structure	(describe the authorities and information sharing within and between organizations and directorates process)
Information needs	(describe the information types and attributes that are shared between actors)
Information flows	(describe which roles and organizations sharing information the direction of information flows)
Information technology	(Describe the software applications, functionalities, systems, hardware devices etc.)
Information ownership	(Describe the information objects the different organization and teams possess)

## APPENDIX V: QUESTIONERS FOR EVALUATION OF THE CREATED ARTIFACTS

### Part 1: Demographic profile of the respondent

Answer the following questions by putting the (√) symbol on the following boxes or write in the space provided.

1. Specify your gender?

Male     Female

2. Your age?

25–34     35–44     45–54     55–64

Others \_\_\_\_\_

3. Your educational level?

Diploma     Master's Degree

Bachelor's Degree     PhD (Doctorate Degree)

Others \_\_\_\_\_

4. Working experience in the organization?

< 5     5-9     10-14     15-19     > 20

Others \_\_\_\_\_

5. Job Title?

Web Designer     Database administrator     Customer manager

Web administrator and master     Marketing expert

Others \_\_\_\_\_

**Part 2: Evaluation user profile**

Please indicate the extent to which you agree or disagree with the following statements by putting a tick (√) mark in the appropriate box.		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	Is Web based IA helping visitors to quickly find relevant information on the web?					
2	Are the Constructed information content and ELIDI information requirement the same?					
3	Is Web based IA useful for user satisfaction?					
4	Does Web based IA enable to improve website design and usability?					
5	Does Web based IA enable to improve service delivering system?					
6	Does Web based IA increase information sharing by recommending pages related to the ones being considered?					
7	Is Web based IA adaptive and easy to use?					
8	Does Web based IA enable information sharing between ELIDI Employee?					