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BUSINESS ARCHITECTURE DEVELOPMENT FOR INTEGRATED AGRICULTURE INFORMATION SYSTEM (IAIS) USING TOGAF FRAMEWORK

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ABSTRACT

Integrated Agriculture Information System (IAIS) is a system that specially manage data, information, and knowledge in Agriculture. Currently, IAIS development is done by arranging blueprint system. Blueprint is developed using Enterprise Architecture approach through TOGAF model framework. This article specifically discusses the Business Architecture Component, which is one of the architectures in TOGAF Framework. The development of IAIS Business Architecture started from the definition of targeted architecture, components, making the architecture. Through architecture development process, it is defined that IAIS has three main goals: (1) Empowering farmers by using ICT tools; (2) architecture and application development for IAIS; (3) IAIS is a connector to all stakeholders in agriculture. To reach those targets, the researchers built organization structure and an actor that is involved in using IAIS. There are four main functions: (1) System, Information Technology Infrastructure, and Organization Standardization; (2) Developing, managing, and maintaining application and infrastructure; (3) IAIS Implementation; (4) Management and Organization. Meanwhile, the services in IAIS are: (1) User Registration; (2) Requesting Application Services; (3) Requesting Information and Communication Technology Training Services; (4) Tendering Services; (5) Requesting Services; (6) Requesting Information; (7) Information Sharing; (8) Consulting (9) Recording and Observing User Specific Data; (10) Giving Agriculture Information and Knowledge.

Keywords: Integrated Agriculture Information System Architecture; Business Architecture, TOGAF Framework.

INTRODUCTION:

Indonesia is one of the largest agricultural countries in the world. During 2010 – 2013, this sector has contributed 14.9% in Indonesia's Gross Domestic Product (GDP) (Direktorat Pangan dan Pertanian, 2013) with 26.14 million of household works in agriculture sector (Badan Pusat Statistik, 2013). Based on those data, agricultural sector has big influence to Indonesia economic and society welfare. One of its ways to improve productivity and quality of agricultural product in Indonesia is by utilization of Information and Communication Technology in Agriculture Sector.

Implementation of Information and Communication Technology in agricultural sector gives some benefits: (1) Increasing agriculture production; (2) Mitigating risk in agriculture sector; (3) Supporting profit optimization to farmers; (4) Increasing effectiveness in information sharing and communication between stakeholder in agriculture sector; (5) Increasing farmer's bargaining power; and (6) Supporting agriculture environmentally friendly (Delima, Santoso, & Purwadi, 2016). ICT brings big benefits to increase productivity, but implementation of ICT is still minimized. Some of the applications of agriculture with Indonesia language as the main language is still limited and can't be accessed, such as publication, public service, and product sales and agriculture tools from some vendors. Meanwhile, some of agricultural website which use Indonesian language as the main language as information and knowledge source is still limited (Delima & Purwadi, 2015). This problem is the main reason to develop Integrated Agriculture Information System (IAIS).

Nowadays, IAIS is still in development phase. This system is specifically in place to process data, information, and knowledge in agriculture sector. IAIS is planned to be an integrated agriculture system that has some connected subsystems and able to link stakeholders in agriculture sector.

The development process of a complex and integrated system needs well planned activities in some phases in order for all components in the system to have good interoperability capacity. System development plan is covered in system blueprint. System blueprint includes strategic development: (1) Organization vision and mission; (2) Data, Information, and Knowledge requirements; (3) Infrastructure requirements; (4) Application requirements; (5) Human resources requirements. Blueprint can be a guidance to develop and implement system.

Enterprise Architecture (EA) approach is used to develop IAIS blueprint. Enterprise Architecture is used because of its ability to integrate all functions in Information Technology with organization business process (Marques, Borges, Sousa, & Pinho, 2011). Enterprise Architecture has 4 different architecture layers: (1) Business Architecture; (2) Application Architecture; (3) Information Architecture and (4) Technical Architecture. This article discusses about the development of Business Architecture for IAIS. Business Architecture Component is developed based on TOGAF Framework. Business Architecture is the second component in TOGAF and has 6 catalogues, 3 matrixes, and 9 diagrams. Business Architecture can help in determining the business activities and stakeholders involved in every business processes. Thus, will ease to develop application and information architecture.

LITERATURE REVIEW:

ENTERPRISE ARCHITECTURE:

Enterprise Architecture is an architecture to design an enterprise system. This architecture involves business process modelling and information characteristics (Schekkerman, 2004). By using EA, an organization can identify system needs to support business process and align the organization needs and information technology functions (Pereira & Sousa, 2005). This architecture is also able to give information and knowledge to decision makers. Enterprise Architecture is able to give integration perspective for all information technology function which is related with organization business process (Marques, Borges, Sousa, & Pinho, 2011). Through this architecture, organization can determine initial step, requirement analysis, and arrange plan to implement information technology components to reach organizational objectives (Anthony, 2008).

Enterprise Architecture is developed based on needs to get Enterprise Architecture framework within organization to describe enterprise by connecting its business, application, information, and technology. Figure 1 shows real practice to categorize elements into architecture layers with its dependency.

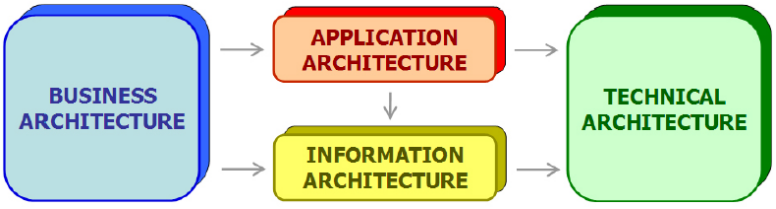

Figure 1: Enterprise Architecture Layer (Enterprise Architecture Solution, 2004)

Enterprise Architecture usage is based on condition that information technology architecture covers Information System and application in the specified business unit. From some companies and enterprises, from different scale of companies, this method is able to be used. Complexity in big companies determine what information system is needed to be built. Thus, Enterprise Architecture has to been standardized and integrated into all level within companies. Without standardization and integration, companies or organizations create its own failure (Stenzel, 2007).

Complexity and dependency within enterprise business unit can be illustrated as a blueprint. Thus, every parts are involved to understand, starts from executive to customers (de Vries & Van Rensburg, 2009). Enterprise Architecture is not the only solution. Enterprise Architecture is a communication tool to draw and give some explanation about information in the form of diagrams and support verbal communication within different stakeholders. In every relationship between business and information technology, Enterprise Architecture is able to be used in strategic, tactical, and operational level.

TOGAF FRAMEWORK:

Technically, TOGAF Framework is used to develop blueprint for IAIS. TOGAF is one of the frameworks for Enterprise Architecture. TOGAF Architecture is used as a tool to support development, implementation, and maintenance of Enterprise Architecture (Horrison, 2009). In terms of advantage, it is its flexibility to collaborate with other frameworks makes this framework special. TOGAF is designed to develop function of its element iteratively. Development phase in TOGAF is known as TOGAF Architecture Development Method (ADM). Figure 2 shows TOGAF Architecture Development Method (ADM).

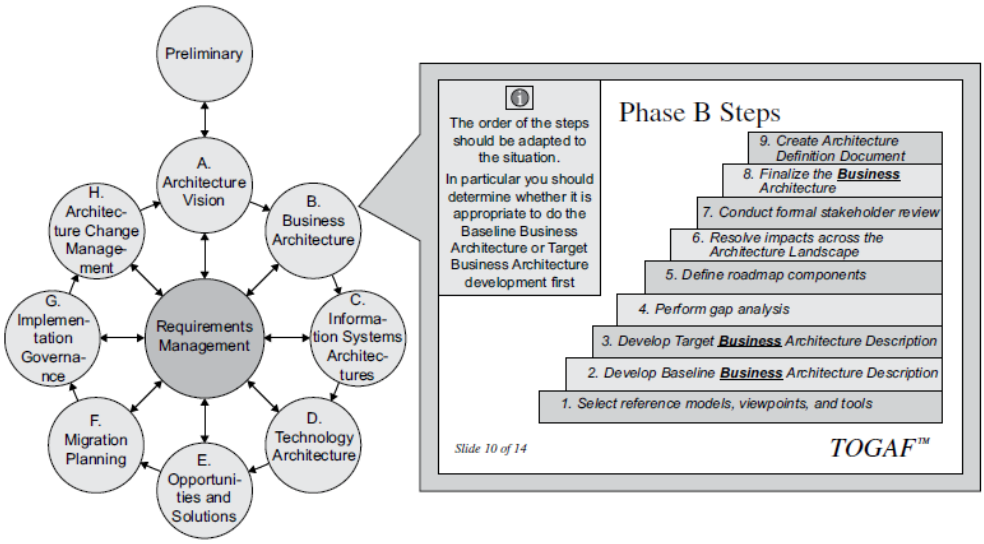

Figure 2: TOGAF Architecture Development Method (Horrison, 2009)

From figure 2, we can see that there are one preliminary phase and eight phases. Those phases are:

1. Preliminary Framework and Principle. This phase is a preliminary stage which determine Enterprise Architecture scope. In this phase, organization commitment is being developed in enterprise architecture.
2. Vision Architecture. This phase focus on the importance vision of enterprise architecture to achieve organization goals. In this phase, some statements are developed: organization profile, vision and mission, organization objective, organization business process, organization unit, and architecture current condition.
3. Business Architecture. This phase determine business model or business activity based on business scenario.
4. Information System Architecture. This phase emphasizes on activity how information systems are built based on business architecture and function. This definition includes data architecture and application architecture.
5. Technology Architecture. This phase decide on technology portfolio including software and hardware.
6. Opportunities and Solution. This phase determine the benefit gained from enterprise architecture through business architecture, data architecture, application architecture, and technology architecture. Those architectures will be indicators to choose and set the architecture to be implemented.
7. Migration planning. This phase evaluates migration system and gap analysis to implement the systems.
8. Implementation Governance. This phase set the organization and IT governance.

9. Architecture Change Management. This phase implements plan for architecture management of the new systems.

Figure 2 (Harrison, 2009) shows business architecture development process which consist of 9 phases: (1) Select reference, viewpoints, and tools; (2) Develop Baseline Business Architecture Description; (3) Develop Target Business Architecture Description; (4) Perform gap analysis; (5) Define roadmap components; (6) Resolve impacts across the architecture landscape; (7) Conduct formal stakeholder review; (8) Finalize the Business Architecture; (9) Create Architecture Definition Documents.

BUSINESS ARCHITECTURE:

Business architecture provides a multi-faceted view of the organization's key components (Wolfenden and Welch, 2000). Business architecture is a strategic and holistic approach that helps to identify, assess, and prioritize opportunities for performance improvement. Business architecture permits the examination of interactions within an organization. In this planning, it also records some management function within organization and business processes in this organization. Thus, the approach builds up a multidimensional blueprint from which an implementation plan can be derived that specifies and prioritizes problematic areas where performance improvements can be targeted (Wolfenden & Welch, 2000).

Business architecture is important to develop since it is a strategic blueprint for the organization. By developing business architecture, organization can take advantage by increasing its productivity and competitiveness. The competitiveness of organizations refers to the ability to produce goods and services efficiently at a reasonable price and high quality (Menchaca A. V., November 2014). Business architecture is also a gateway to develop information system architecture according to TOGAF. Thus, there is a relationship between business and information technology.

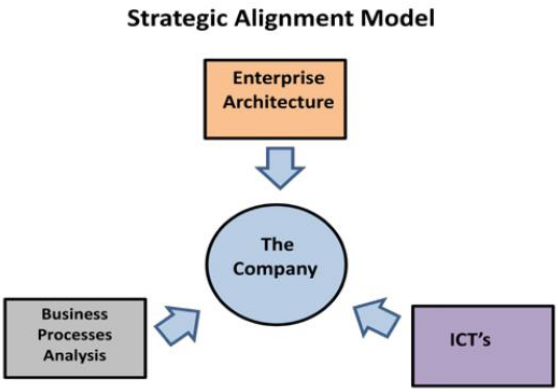

Figure 3: Strategic Alignment Model (Menchaca A. V., November 2014)

Figure 3 shows the alignment between business process analysis, enterprise architecture, and ICT. With these premises, the first step is to develop Business Architecture. The main objective by defining the Business Architecture is to define the business, documenting organizational structure, identifying, and defining business function and processes relying on strategic planning with their areas of internet (Menchacha, 2014). Business Architecture can be some points: mission, vision, objectives, goals, values and policies, business processes, procedures and functions, organizational structure, situational analysis, customers, markets, products and long, medium, and short strategies (Menchaca, et al., December 2013).

RESEARCH METHODOLOGY:

There are five steps in this methodology to develop business architecture: (1) Select model and viewpoints; (2) Determine business architecture goals; (3) Develop architecture component; (4) Socialize architecture; (5) Finalize architecture. This article specifically construct four initial steps in the development of business architecture.

DETERMINING BUSINESS ARCHITECTURE GOALS:

Next step to develop business architecture for IAIS Blueprint is determining business architecture goals. Researchers skip the process of developing baseline business architecture because IAIS is the first system to be developed. Thus, in the development of business architecture, i the step of determining baseline and gap analysis

can be ignored. Based on current conditions, there are three goals of IAIS Architecture: (1) Empowering farmers to use ICT Tools; (2) Creating and Developing Architecture and Application for IAIS; (3) IAIS is a communication tools for every agriculture stakeholders.

DEVELOPING ARCHITECTURE COMPONENTS:

In TOGAF Version 9, it is defined that business architecture components consists of 7 catalogues, 2 matrixes, and 9 diagrams. Those architecture components can be seen in Table 1: Business Architecture Components in IAIS Blueprint.

Table 1: Business Architecture Components in IAIS Blueprint

Catalog	Matrix	Diagram
Organization/actor	Business Interaction	Business Footprint
Driver/Goal/Objective	Actor/Role	Business Service/Information
Role		Functional Decomposition
Business Service/Function		Product Lifecycle
Location		Goal/Objective/Service
Process/Event/Control/Product		Business Use Case
Contract/Measure		Organization Decomposition
		Process Flow
		Event

DEVELOPING ARCHITECTURE:

IAIS Business Architecture consists of three main parts such as Business Motivation, IAIS Organization, and Business Services & Functions. Business motivation elaborate goal, objective, and drivers of the architecture. IAIS Organization tells us actor, role, and organization structure of IAIS Developers. The last part gives definition about IAIS services and its correlation with organization roles.

ANALYSIS AND DISCUSSION:

BUSINESS MOTIVATION:

Organization business motivation reflects relationship between organization goals, objectives, organization drivers, and responsible actors in organization in order to achieve goals. IAIS developer organization is a study group for faculty member in Information Technology Faculty Duta Wacana Christian University. This organization has three main goals: (1) Farmers Empowerment to use ICT Tools; (2) Developing Architecture and Application for IAIS; (3) IAIS as a communication tools among stakeholders in agriculture sector. Table 2 describes relationship between IAIS Goals, Objectives, and Drivers.

Table 2: Goal, Objective, and Driver IAIS

Goal	Objective	Driver
Farmers Empowerment in Using ICT Tools	The number of farmers who use ICT to help in their agriculture processes	Increasing farmer's abilities and capabilities
	Establish Online Community	Increasing farmer's role in modern farming based on community and ICT
		Increasing farmers access to information and farming technology
Development of Architecture and Application for (IAIS) Integrated Agriculture Information System	Blueprint strategy for system development	Modern agriculture requires the support of ICT
	Availability of IT Infrastructure	Increasing technology infrastructure
	Development of Agriculture Information Systems and Knowledge Based Systems	Increasing of ICT role to increase productivity in agriculture sector
		Increasing of farmer's access to information and farming technology
Connecting Agricultural Stakeholders Through IAIS	Number of Stakeholders Involved and Using The Application	The availability of applications that can connect agricultural Stakeholders.
	The Formation of Online Communities for Stakeholders and the number of stakeholders involved	Increasing need for online communication

IAIS ORGANIZATION:

Organization definition of Business Architecture contains unit definition organization, actor, roles, and locations. Developer organization in IAIS is study group IAIS. This study group is a part of faculty member of Information Technology Faculty Duta Wacana Christian University. This organization is led by a chairman and has 4 main divisions: System Research and Development, Service and Training Division, Quality Assurance Division, and Governance Division. Otherwise, the stakeholder in IAIS can be grouped into four categories such as Academician, Public Sector, Private Sector, and Farmers. Farmers are the most important stakeholders in this system. Organization unit and actors of this group can be seen in Table 3 below:

Table 3: Organization and Actor Catalog

Organization Unit	Actor
Study Group	Study Group Chairman
Research and Development System	Division Head
	Application and Technology Infrastructure Sub Division Head
	Database and Knowledge Sub Division Head
	Head of Application Development Unit
	Head of Application Maintenance Unit
	Head of Technology Infrastructure Development and Maintenance Unit
	Head of Data Administration Unit
	Head of Knowledge Administration Unit
	Application Development Staff
	Application Maintenance Staff
	Technology Infrastructure Development and Maintenance Staff
	Data Administration Staff
	Knowledge Administration Staff
Services and Training Division	Division Head
	Service Sub Division Head
	Training Sub Division Head
	Service Staff
	Training Staff
Quality Assurance Division	Division Head
	IAIS Product Quality Assurance Sub Division Head
	IT Governance Quality Assurance Sub Division Head
	IAIS Product Quality Assurance Staff
	IT Governance Quality Assurance Staff
Governance Division	Division Head
	Public Service Sub Division
	Finance Sub Division
	Public Service Staff
	Finance Sub Division
Stakeholder	
Farmers	Farmers
	Farmers Community
Academician	Academician of Information Technology
	Academician of Agriculture
	Information Technology Practitioner
	Agriculture Instructor
Public Sector	Government
	NGO
Private Sector	Supplier

Organization Unit	Actor
	Distributor
	Cooperative
	Financial Institutions
	Fertilizer and Pesticide Industry
	Telecommunication Operator / Provider
	Courier and Transportation Services

BUSINESS SERVICES AND FUNCTIONS:

IAIS Business Architecture accommodates all services provided by IAIS. There are 10 (ten) IAIS services: (1) User Registration; (2) Requesting Application Services; (3) Requesting Information and Communication Technology Training Services; (4) Tendering Services; (5) Requesting Services; (6) Requesting Information; (7) Information Sharing; (8) Consulting (9) Recording and Observing User Specific Data; (10) Giving Agriculture Information and Knowledge. Relationship between business services and actor can be seen in Business Use Case Diagram as stated in the figure 4 below:

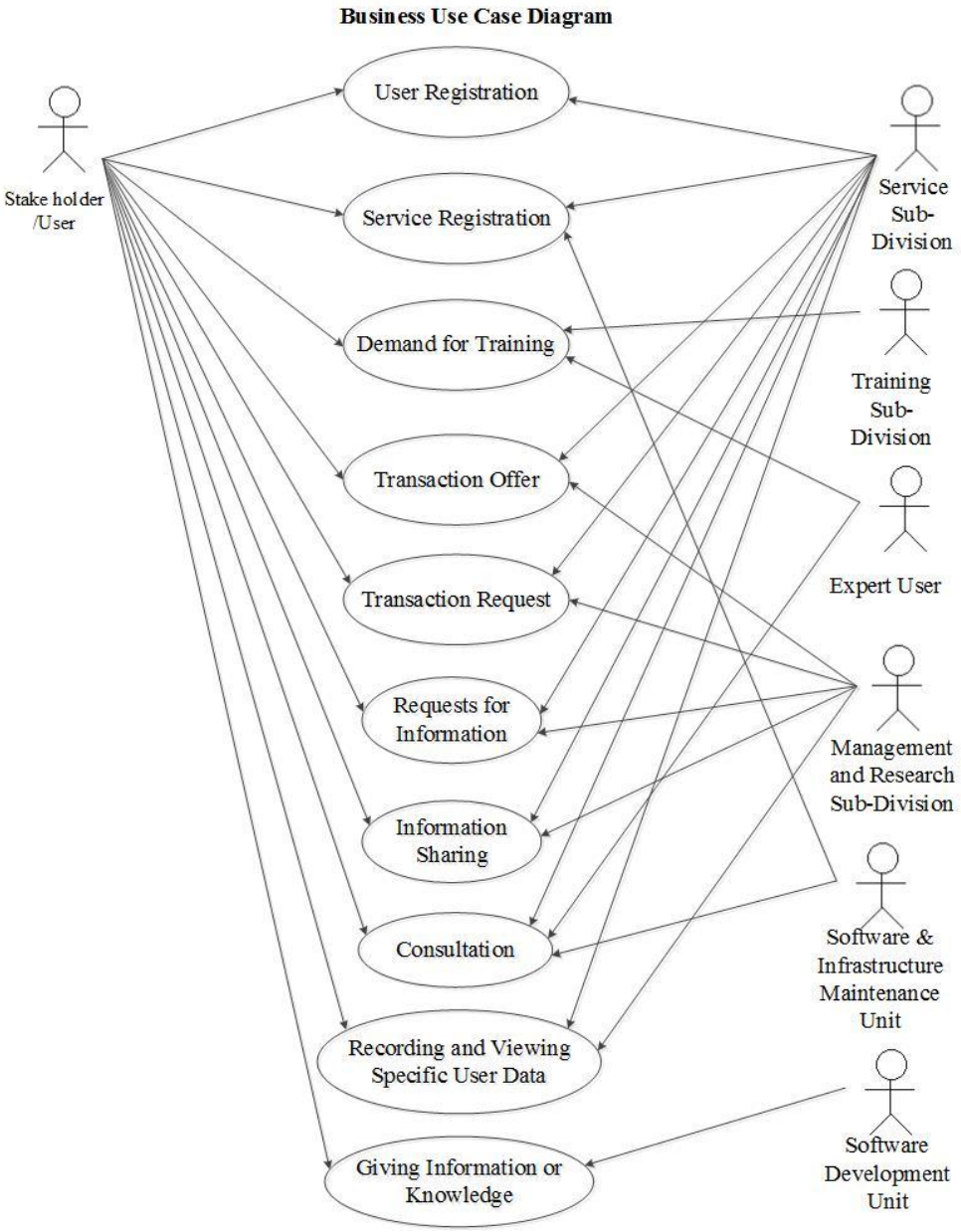

Figure 4: IAIS Business Use Case Diagram

IAIS has four main business functions: (1) System, Information Technology Infrastructure, and Organization Standardization; (2) Developing, managing, and maintaining application and infrastructure; (3) IAIS Implementation; (4) Management and Organization. Relationship between business function and actor can be seen in figure 5 below:

Figure 6 shows the relationship between services and business function in IAIS. Overall, relationship between goal, objective, actor, services, and function can be seen in figure 7, figure 8, and figure 9.

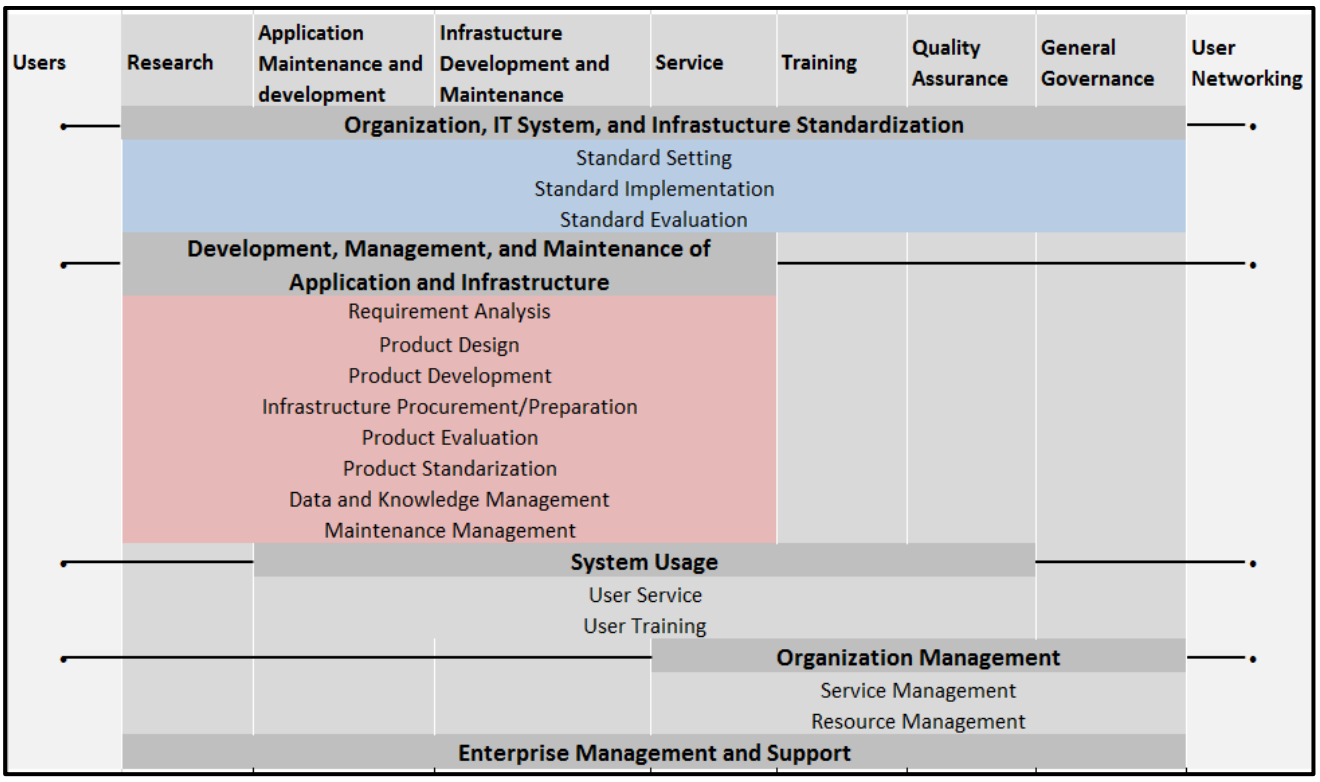

Figure 5: IAIS Functional Decomposition Diagram

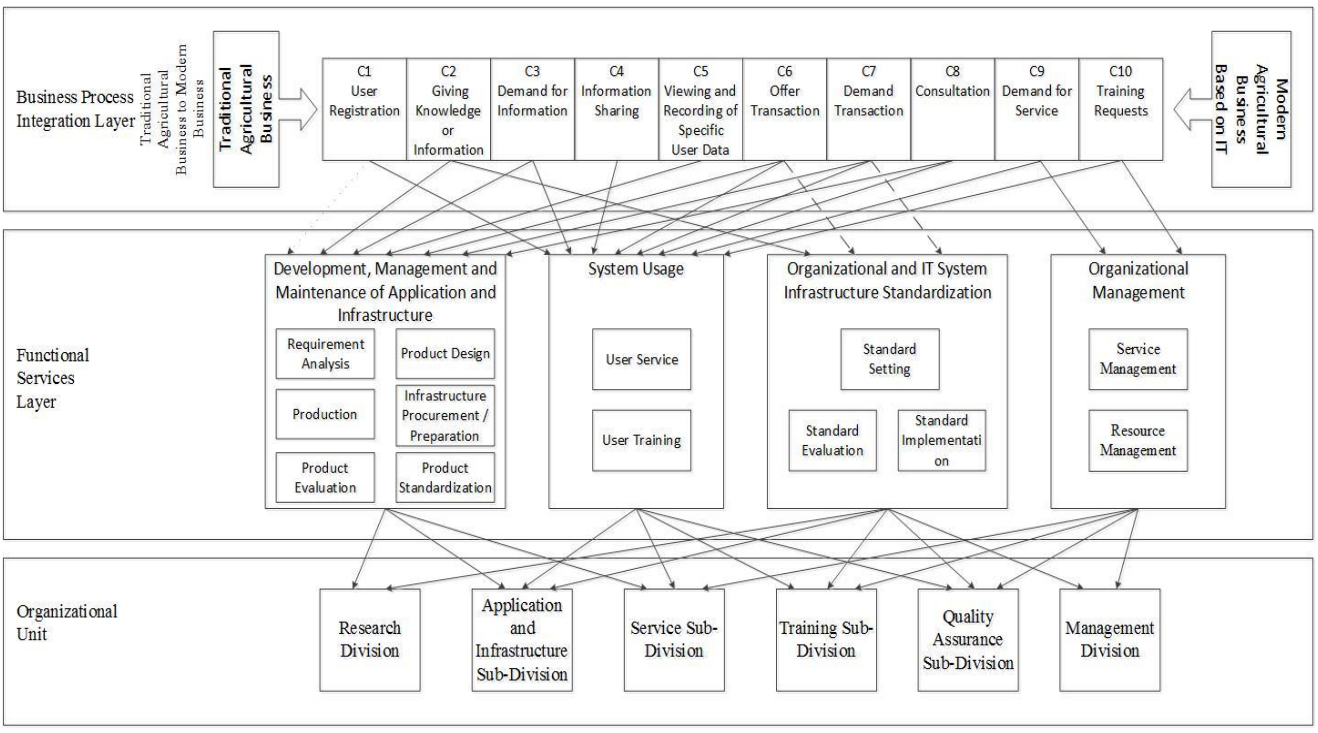

Figure 6: IAIS Business Services and Functional Diagram

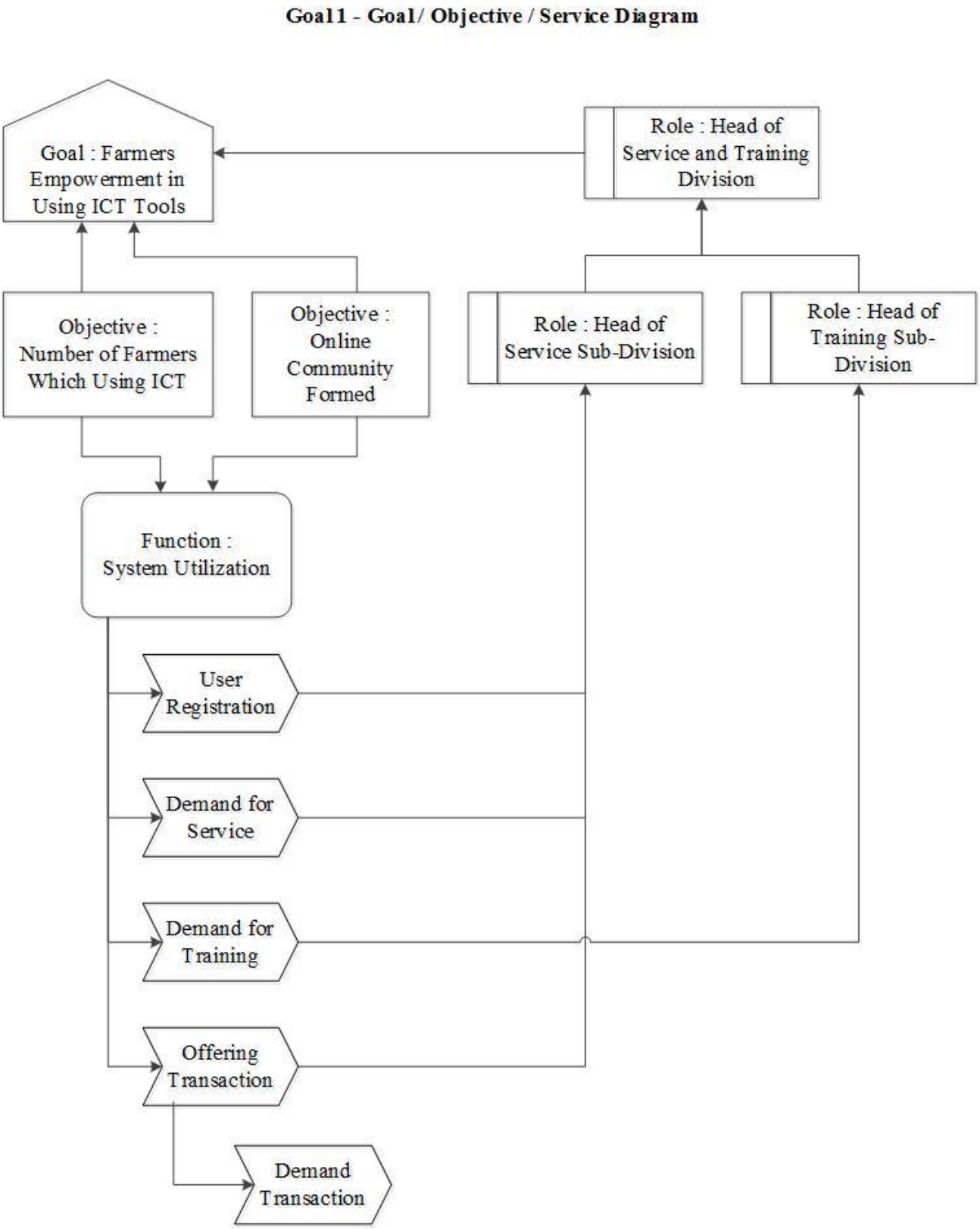

Figure 7: IAIS First Goal, Objective, Function, Services, and Actors Diagram

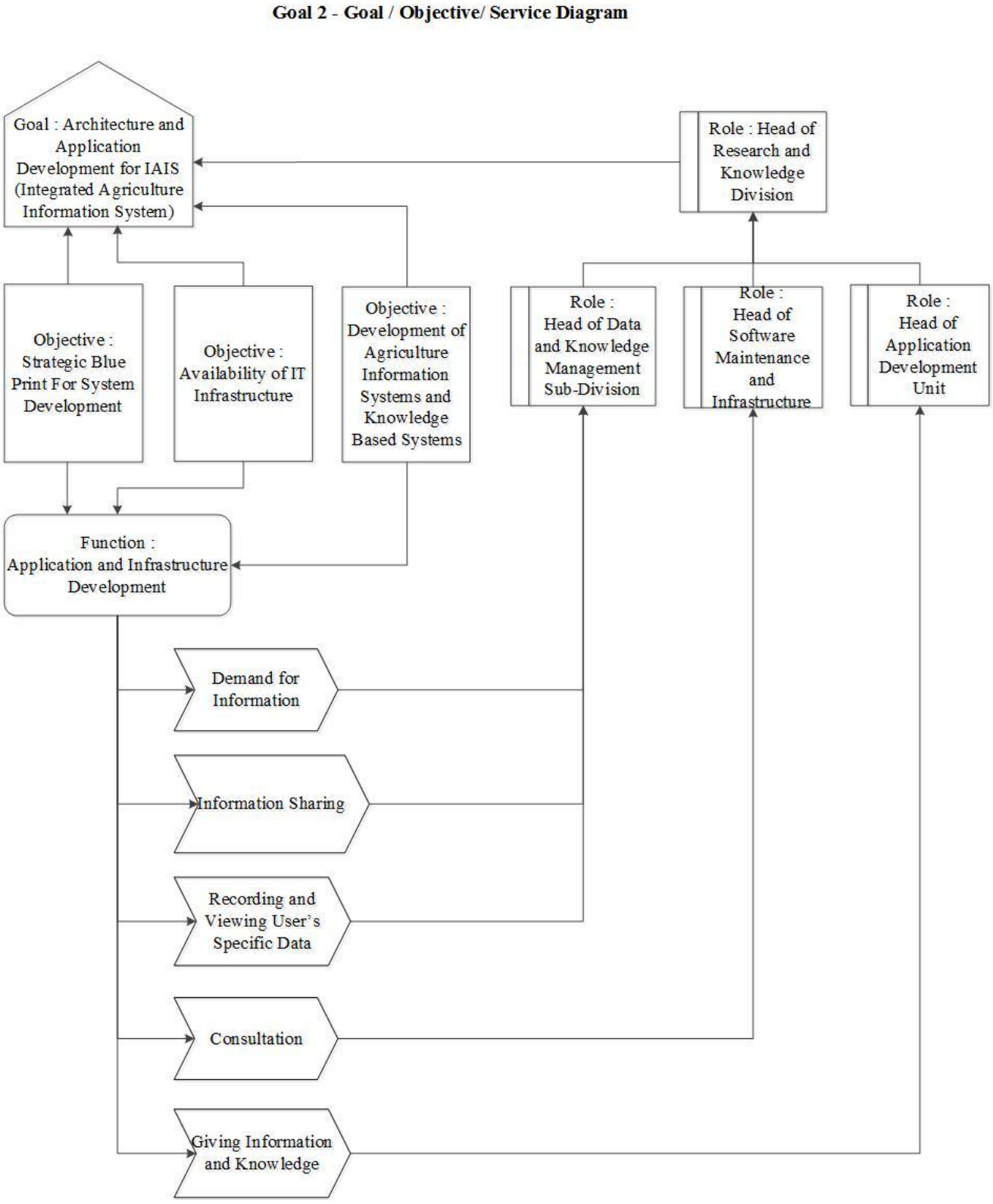

Figure 8: IAIS Second Goal, Objective, Function, Services, and Actors Diagram

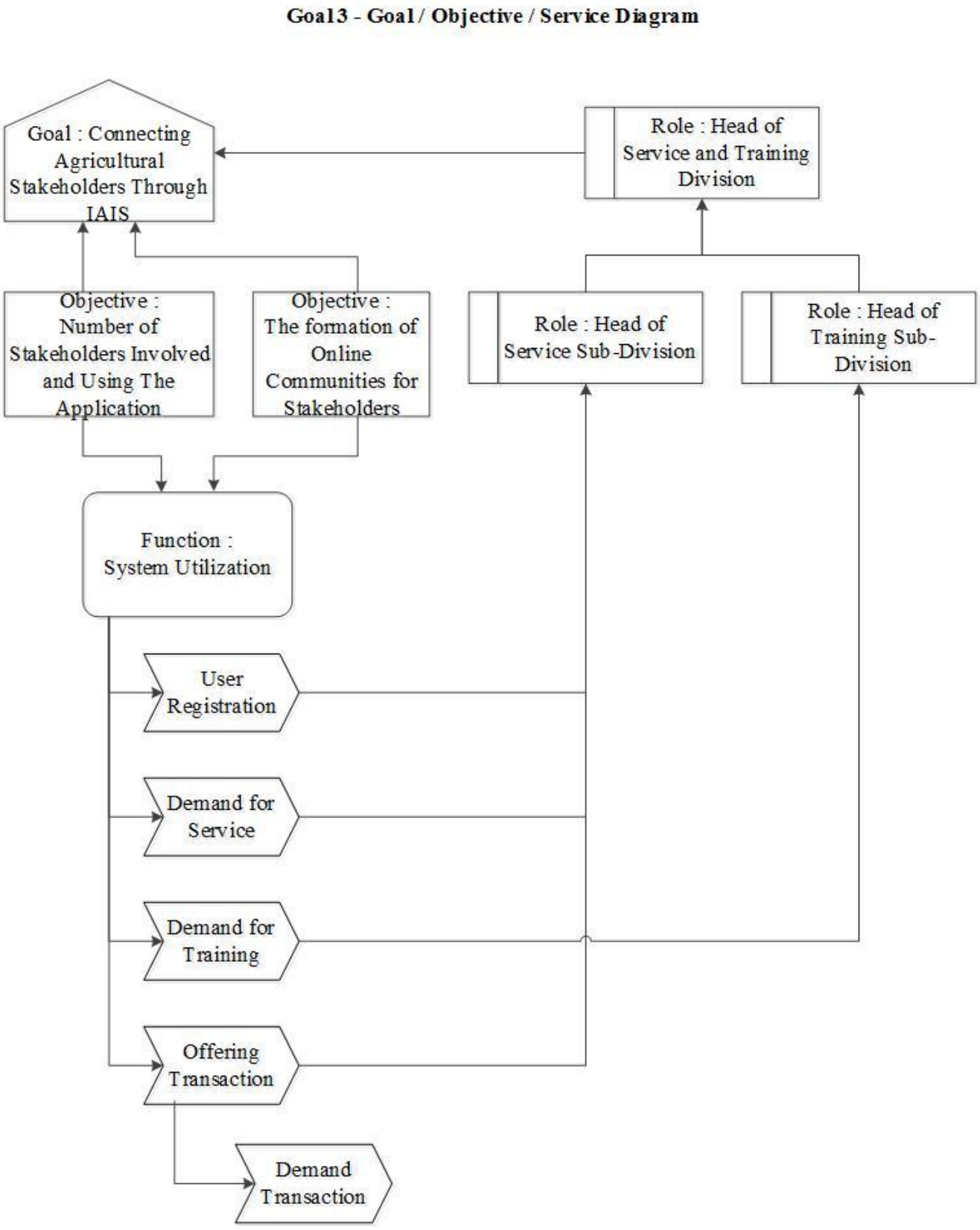

Figure 9: IAIS Third Goal, Objective, Function, Services, and Actors Diagram

CONCLUSION:

Based on the analysis, it can be concluded:

1. IAIS Architecture has three main targets such as (1) Farmers Empowerment to use ICT Tools; (2) Developing Architecture and Application for IAIS and (3) IAIS as a communication tools among stakeholders in agriculture sector.
2. IAIS Developer Organization has four divisions such as System Research and Development, Service and Training Division, Quality Assurance Division, and Governance Division
3. There are four functions and ten services offered by IAIS. Those 4 functions are: (1) System, Information Technology Infrastructure, and Organization Standardization; (2) Developing, managing, and maintaining application and infrastructure; (3) IAIS Implementation; (4) Management and Organization. The ten services offered are (1) User Registration; (2) Requesting Application Services; (3) Requesting Information and Communication Technology Training Services; (4) Tendering Services; (5) Requesting Services; (6) Requesting Information; (7) Information Sharing; (8) Consulting (9) Recording and Observing User Specific Data; (10) Giving Agriculture Information and Knowledge

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