

Achieving Organizational Interoperability for Agricultural Research with Cross Organizational Business Process Modeling

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Abstract

A layered approach to interoperability between multiple e-systems (e-government, e-health, etc.) has been considered by both the industry and academia; long been exercised, with organizational, semantic, syntactic and technical interoperability identified as the possible layers. While practical solutions have been discovered and well tested for the lower three layers, the development and utilization of interoperable information systems is still held back by different issues of organizational interoperability layer, and remained to be a challenge in the software engineering discipline. As such, issues pertaining to organizational layer in the interoperability spectrum have been actively investigated and endeavors to come up with a holistic solution are underway. Recent works in this area promote the use of business process standardization and ensuring legal and strategic interoperability across organizations for organizational layer problems.

In this paper, business process modeling across multiple organizations is investigated within different governmental institutions taking part in agricultural research activities in Ethiopia.

The research takes a form of investigative approach and constructing a business process network model between participating institutions, followed by establishing organizational matrix setup and formulate governance frameworks to ensure organizational interoperability. The result of the research showed the possibility of business process modeling across multiple collaborating institutions as long as they share common goals and strategies. Business Process Modeling Notation (BPMN) is used for depicting the business process choreography between institutions. Lastly, the modeled business process, connecting multiple institutions, is used to model a SOA based solution using Web services.

Keywords: Organizational Interoperability; Cross organizational Business Process; BPMN; SOA

1. Introduction

Different layers of interoperability have been identified at different times. The European Interoperability Framework (EIF) classifies interoperability into three layers: Technical, Semantic, and Organizational with reference to three dimensions of organizational interoperability insights from recent studies for improving interoperability frameworks in [1]. The European Standards Institute added a syntactic layer between the technical and semantic layers of EIF [1]. Other researchers and standards bodies considered the mentioned four layers of interoperability by adding legal, strategic, governance, and crosscutting issues into the frameworks [1].

The organizational interoperability layer, which is a crucial component of the interoperability

requirements, is the one with less common understanding. The gap emerged from the specific concerns of each of the groups and lack of holistic views to the problem. In an effort to improve the existing interoperability frameworks, the authors in [1] suggested the redefinition of the presently called organizational interoperability to be limited to business process interoperability standards and concepts concerned with the linkage of business processes between collaborating institutions.

In order to align activities and support decision making at different levels, considering enterprise architectures is important for supporting interoperability on cross organizational business process. The enterprise architecture will help organizing mechanisms to structure concepts. There are different enterprise architecture frameworks in order to support modeling business process [2]. In

this paper it is tired to consider different enterprise architectures as solution for organizational interoperability with different issues raised while implementing.

2. Background

Governments must avail services for citizens and to other stakeholders. As government institutions, they must share and use information about their common customers in order to work together. To achieve the requirements of service delivery, institutions need to exchange information about service provision, the common customers and the processes. This last requirement was termed interoperability by practitioners and researchers in the field. Interoperability between two or more institutions can be described as the ability of the participants to share relevant information in a timely manner and use the shared information to effectively and efficiently work together [3, 4]. Interoperability between institutions can be achieved with common understanding among different institutions working together. That means institutions must have rules, regulations, and governance in order to work together. Since working together means sharing information based on the specified rules and regulations stated in the governance, those institutions must act accordingly. Information sharing alone will not result in an effective and efficient performance. In order to successfully implement interoperability, the institutions participating in the provision of services crossing organizational boundaries must agree with each other on the level of their collaboration. For the institutions to use the shared information, it must be clearly understandable and support the service provision [5].

3. Proposed Solution

In order to achieve organizational interoperability, different institutions that are working together for shared services must have common understanding on the service shared and also must sign service level agreement on which each institution has responsibility for the continuity of cross boundary services. Interoperability is central to any form of collaboration between organizations, as it enables information and knowledge sharing by cooperating

entities within and across organizational boundaries [6]. Interoperability is important for different stakeholders that use the services from public sectors for effectively working together on cross boundary services. Different enterprise architectures are found that comprise models and tools that can support and develop IT applications within an enterprise [6]. Adapting Enterprise Architecture must undertake rigorous study on the business and IT governance of the business process in order to achieve interoperability. As a solution and before adapting Enterprise Architecture, considering cross organizational business process model must be undertaken.

In order to reach to a solution, this paper proposes modeling cross boundary business processes and assign mandates to different institutions that are working with cross boundary institutions. Accordingly, there must be formulation of an organizational matrix setup on different institution work performers to give responsibility for the established organizational setup in order to handle the modeled and implemented cross boundary services within different agricultural institutions. In this regard, setting up new organizational structure to handle the modeled cross organization business processes is very critical. The Ethiopian Government has developed a growth and transformation plan on the agriculture and rural development sector for formulation of need based policies and strategies and capacitating the human resource skill so as to use the human resource in different agriculture sectors. Using land resources in efficient and effective way, developing different agriculture ecological products within different zones for developing the regional capacity, entrenching specialization and diversification, coordinating agricultural and rural development proceedings, and strengthening the agriculture strategy and development in depth are also central to the growth and transformation plan.

In order to effectively and efficiently deliver agricultural research services, the role of the designed business process model is important in addressing cross boundary services within different livestock agricultural research institutions for shared services. Therefore, the establishment of

organizational matrix setup is considered below in order to achieve the following advantages:

- Enhance collaboration and coordination of work performance,
- Strictly follow the performance of each cross boundary service for agricultural research institutions performance on shared services,
- Create accountability and transparency for cross boundary services and clearly show inactive work performers with different institution, and
- Appropriate and on time decision making for cross boundary business process for shared service.

4. Experimentation/Prototype

The business process network model diagram shown in Figure 1 illustrates the entire business process for agriculture research on livestock service delivery. The diagram can be elaborated as follows: Research problems will be identified by different researchers working in research institutions. In order to undertake data collection, researchers from EIAR and MOA will communicate the regional, zonal and woreda bureaus. The collected data will be analyzed and recommendation will be generated in order to undertake research. Different researchers will draft their proposals based on the gathered data from zonal and woreda levels. At regional level there will be meetings on prioritizing the proposals that can cover the regional current issues with best solution. Once

the regional, zonal and woreda levels have decided to approve proposals, the regional bureau will send the prioritized proposals to federal research institutions. In federal research institutions, there will also be a meeting on selecting the current issues in different regions with scientific justification and cost analysis breakdown. In the meeting, researchers from international livestock researcher institutions and federal and regional institutions will meet and make a decision on selection of the different regions problem solving. After a presentation of each regional researchers and the committee (research directors) review on proposal paper acceptance and rejection of research papers will be made. The approved proposal will be appended by a financial budget to undertake the research. Each region will present the approved proposals with the financial implications for MoFED. MoFED will approve the research budget in each region. Once the research budget has been approved, the research director will communicate each research institution that is implementing the research proposal. Research will be conducted and for verification of technologies different stakeholders will be communicated. Researchers from MOA, EIAR, and RARI will be invited and approve the technology. Once the technology is tested in both the laboratory and the field and the technology is approved, a request letter will be provided for MOA. MOA is responsible for information sharing and technology dissemination.

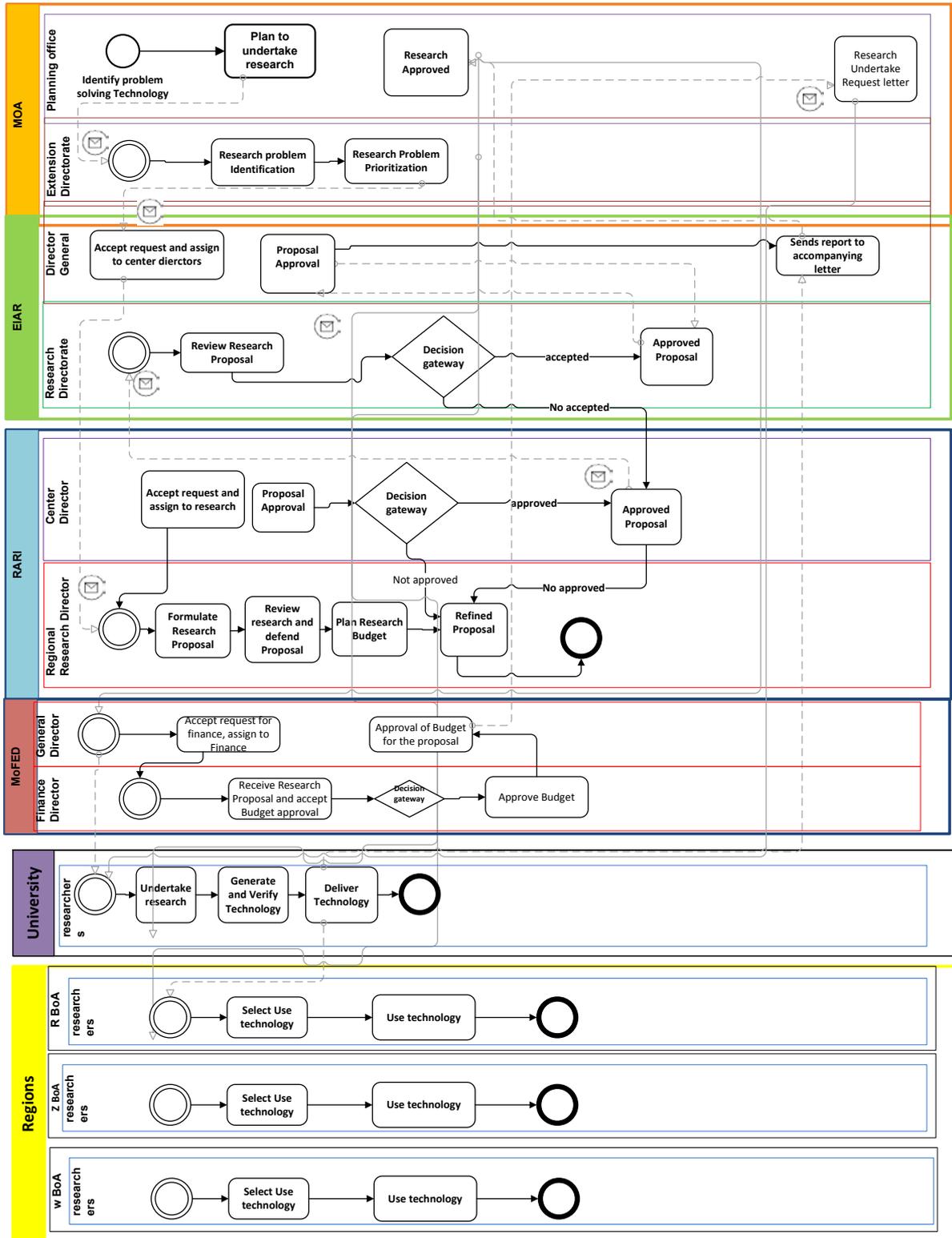


Figure 1: Overall livestock service delivery business process

5. Related Work

Government institutions need to collaborate in order to improve citizen service delivery. Institutions need to work across portfolio boundaries to find collaborative, networked and multi-communication channel approaches to deliver information and

services from business to citizens [2]. Development of an interoperable framework provides an integrated service by articulating a set of agreed policies, principles, and standards to facilitate information and transactions from government to all stakeholders. Improving the capability of cross institutions means

communication is confidently managed, transferred and an exchange of information and data [7].

The World Bank defined e-government as the use by government agencies of information technologies that have the ability to transform relations with citizen business and other arm of the government. E-government simply means the use of ICT to improve the activities of public or private sector institutions [8].

The technologies enable governments in various ways including effective and efficient service delivery of government services to citizens, improving interactions between institutions, and sufficient information access that will result in more efficient and effective government management [8]. E-government encompasses all ICT technologies but the key motive is to create strong connection between government sectors. The connectivity and collaboration project will strengthen accountability, connections between government and business/citizens transforming service delivery [1]. Generally, e-government promises to make government more efficient, responsive, transparent, and legitimate and is also creating a rapidly growing market of goods and services, with a variety of new business opportunities [9].

It has been a while since the implementation of e-government started in Africa. There are growing numbers of e-government projects, some of which are contributing to public sector reform and delivering gains of efficiency and or effectiveness across a broad agenda. However, this picture must be set alongside significant challenges.

In order to achieve interoperability, institutions must communicate effectively. For service consumers to communicate with the service provider, a communication channel must be established first and there must be a communication media on which institutions can exchange data or information using shared services. In order to communicate within the institutions, the shared service must be clearly understood and use same understanding level for information exchange [10]. Only the presence of a communication channel and data or information exchange between institutions that have shared service will not be enough; the institutions must be

able to use the shared services [11]. For effective use of shared services, the institutions must have service level agreement [12].

Cross organizations boundary requires the study of organizational governance, existing business processes, IT services and technologies to effectively and efficiently work together in order to support the service delivered. There is an interest to go towards implementing e-government services in government institutions in Ethiopia. It is mandatory to consider how cross organizational business processes are modeled to identify cross boundary services. Even though there are different Enterprise Architectures developed, cross organizational business process and service interoperability is not described in detail. Different countries across the world have exercised implementing e-government services such as the USA, UK, Belgium, Australia, and others. They have built their own government interoperability framework.

From African countries, South Africa and Egypt have adopted one of the Enterprise Architectures [13]. The Ethiopian government is working on implementing e-government applications for 22 Ministries and Agencies, out of which Agriculture is one of the most focused sectors on which the government gives much attention since agriculture is the main backbone for Ethiopian Economy [14].

The Agricultural Economy holds 80% of the country's rural development program. The Agricultural Economy holds 45% of the country's annual income. 90% of the country's export income is from agricultural products. 85% of employment opportunity relies on agriculture. Therefore, the Ethiopian government will raise 15% of the country's annual budget. This clearly shows that the government of Ethiopia has wide attention for the agricultural sector [15].

Tesfaye Debela in [9] discussed how business process shall be guided with the theory and practices of institutions. BPR has very strong points where the business process of the institutions will be improved through supporting governance of an institution with implementation of Business Process Reengineering [15].

A few years back, the Ethiopian government has not formulated ICT policies, but now MCIT is working on producing governmental ICT policies that can be adapted by different institutions [14]. In the past, there is lack of standard documents such as ICT standards, polices, Data Center standards, enterprise level security framework, document on information sharing policies, alignment of IT with business requirement, Interoperability Framework, Information Security Standard, cross boundary service level agreement for shared services, adoption of appropriate policies or standards for different technology, application process and architecture are very critical for implementing e-government services.

6. Enterprise Architecture Frameworks

Consideration of Enterprise Architecture from different perspectives has been exerted in this research to identify the limitations that Enterprise Architectures have in handling cross organizational business process for shared services for implementing e-government applications.

Selection of an Enterprise Architecture is based on goals and outcomes or based on approaches in general [16]. A comparison of five Enterprise Architecture are considered even though different Enterprise Architectures have their own advantages. In order to select an appropriate Enterprise Architecture, there must be a feasibility study on the business process and understanding the application software use and characteristics [17]. From different Literature review, Zachman Enterprise Architecture framework is useful for classifying the various architectural artifacts [18, 19] institutions practice guidance is more detail described by Gartner Enterprise Architecture. TOGAF Enterprise Architecture describes process completeness and information about institutions. FEA Enterprise Architecture describes more on organization Maturity Model descriptions and Reference Model Guidance, Partitioning Guidance and Perspective catalog [20]. Both FEA and Gartner Enterprise Architectures describe Governance Guidance, Business focus and Time to value. Five enterprise architecture frameworks have been examined in this paper in order to understand cross organizational

business process model for each architectural design. Different information resources such as “Overview of an existing Enterprise Architectures Frameworks” [19] and “A Comparison of the Top Four Enterprise-Architecture Methodologies” have overview on architectural frameworks [16]. Zachman Enterprise Architecture which is the most comprehensive from all Enterprise Architectures is Timeline framework abstraction. Zachman establish Vocabulary set of perspective for describing Enterprise systems using six by six matrixes [17, 18, 22]. DODAF is developed by US defense, the Enterprise Architecture view with three perspectives and linkage between the views defined in dictionary to define terms. FEAF designed by the US government to follow industry trend design Architecture Framework is a practical guide for Enterprise Architecture Framework. FEAF contains guidance and is oriented towards Enterprise Architecture to IT Architecture. TEAF information view is same description like FEAF Data Architecture. TEFA is facilitating integration, information sharing, and exploitation of requirement across departments. It describes work product for documenting and modeling Enterprise Architecture, align with FEAF model and DODAF product. TEAF functional view is same description as FEAF application Architecture. TEAF information view is same description as FEAF technology Architecture. Only TEAF has organizational view. The Enterprise Architecture is TOGAF which focuses on mission critical business application that uses open system building blocks using AMD. TOGAF has strong business architecture and technology architecture view. TOGAF is comprehensive on process involved. TOGAF is more to provide guidance [20, 21].

7. Conclusion and Future Work

This paper has identified existing problem within different governmental institutions while working together for delivering services to citizens. The considered business process study focused on cross organizational business process boundary for shared services. In order to address the existing problems within agricultural research institutions cross organizational business process was considered. The Ethiopian agriculture sector has been selected in

order to consider the existing problems. The agriculture sector has different research institutions that are working on problem identifying, prioritizing, planning, undertaking research, verifying technology and disseminating technology produced for different stakeholders such as farmers, pastoralists, investors, and citizens.

In this research it was tried to show alignment of business and IT can be easy when, the institutions business process has been clearly studied within the different institutions participating for shared services. And as long as the participating institutions share similar government goals and strategies, use of cross organizational boundary business process modeling can lead to organizational interoperability through the use of standard policy, rules and regulation effectively implementation.

Implementing e-government service is not an easy task since different considerations on business governance, Political Governance, IT Governance and other Governance must be studied. Therefore; the paper tried to show clearly how much considering cross organizational business process is very important in order to reach interoperability within different governmental institutions that are working for shared services.

In this research it was tried to show there is a problem in organizational interoperability within different governmental institutions that are working for common goal and strategies by using a case study on agriculture research system. Organizational interoperability is still a research area in different institutions. Therefore, considering different case studies and identify framework that can solved the particular problem with a careful consideration of the business and IT governance.

Even though this research has only considered livestock research system; the existing problems on cross organizational business process are shown within the different governmental institutions in Ethiopia. In order to achieve interoperability among different governmental institutions; modeling cross boundary services is an ideal solution but modeling the business process model is not the only solution but there must be organizational setup in order to

control, monitor and evaluate cross boundary services within different institutions.

By modeling cross organizational business process and studying the governance (both business governance and IT governance) an alignment of business process with IT solutions will be achieved.

Since the government is implementing different e-services applications for different ministries and agencies, considering cross organizational business process for shared service is very critical in order to achieve interoperability within the different institutions to successfully implement e-government services that is addressable to different stakeholders.

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