Collaborative Framework for Supporting Indigenous Knowledge Management

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ABSTRACT
Indigenous knowledge (IK) is an integral part of the culture and history of local communities. We need to learn from local communities to enrich the development process. IK systems are also dynamic; new knowledge is continuously added. IK is stored in people's memories, activities and is expressed and communicated orally and this posses a serious threat to its preservation and development. However this depicts Indigenous knowledge Management (IKM) as a complex, global and dynamic issue and hence a need for a collaborative framework that will enhance information exchange. Utilization of collaborative frameworks, are increasingly being used in solving problems whose efficiency depends on an interactive nature. Networking or collaboration allows for a more effective pooling of resources and sharing of experiences and information on indigenous knowledge, both among various individuals and organizations.

Categories and Subject Descriptors
H. 3.2 [**Information Systems**]: File Organization

General Terms
Management, Design, Theory, Verification.

Keywords
To put the thesis in context, this research uses four theoretical terms namely; "Collaborative Frameworks", "KMS -Knowledge Management System", "IK - Indigenous Knowledge" and "Collaborative Framework for Supporting Indigenous Knowledge Management".

1. INTRODUCTION
Indigenous Knowledge and its management (Obomsawin, 2002 [29]; Eyzaguirre, 2001 [11]; Rahman, 2000 [32]; Kolawole, 2001 [22]; Grenier (1998) [14];) has become an area of critical research and an important development issue relating to sustainable development in developing countries. There is a need for a collaborative framework that may enhance global, regional and national networking and information exchange among Indigenous Knowledge (IK) resource centers, researchers and users. The developments in internet technology and proliferation of desktop computing has necessitated the need to develop professional networks in sharing and disseminating indigenous knowledge among practioners. Over centuries, indigenous people have developed their own, locality-specific knowledge and practices of agriculture, natural resource management, human and animal health, education, and many other subjects (Eyzaguirre, 2001 [11]), this knowledge, beliefs and practices is generally known as indigenous knowledge (IK). IK has and will continue to provide alternative strategies for survival to many communities and without these forms of knowledge, such communities would have long been extinct and hence a need for further collaborative development, management and utilization of IK (Warren *et al.*, 1998 [42]).

Many solutions to IK management have been suggested and implemented including setting up, electronic databases, audio and video recordings, interactive tools and multimedia presentations and these have become available to extend the techniques for capturing requirements and disseminating content relating to IK. Today, a range of technologies from computers to video-conferencing for distance learning offers unprecedented opportunities to disseminate know-how and insights rapidly and cheaply to a worldwide audience. Participatory Computer Based Decision Support Systems as well as Comprehensive and Integrated knowledge bases (Rahman, 2000 [32]) with the aim of ensuring access, benefit sharing and documentation of IK in developing countries are also being used. There is a need to develop a collaborative knowledge-sharing IK Framework to enable individuals to share what they know with others in different areas of IK.

Interest in indigenous knowledge and its management has been expressed in a growing number of academic disciplines (Warren *et al.*, 1998 [42]). A decade ago most of the academics working in the area of indigenous knowledge were mainly anthropologists, development sociologists and geography but today spans into other areas including information Technology.

IK is stored in peoples memories activities and is expressed and communicated orally and this pauses a serious threat to its preservation and development (Obomsawin, 2002) [29]. The inadequacy of IK management and sharing has been that most of it has been confined to tacit knowledge and hence it has not been

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codified, limiting its access, storage and retrieval (Obomsawin, 2002) [29];Grenier (1998) [14]).

IK systems are also dynamic; new knowledge is continuously added, however for IK to survive there has to be a dynamic knowledge system for capturing and codification of tacit knowledge and facilitates interchange between tacit and explicit knowledge Grenier (1998) [14]and hence this will enhance collaborations, management and utilisation of IK (Schreiber *et al.*, 2000) [33].

1.1 Definition of the theoretical terms used in the research

A framework is a model or a simplified description of a complex entity or process (Cai (2004) [19]); Li *et al.*,2005 [23]), which may include methods, tools and techniques. In this research a **Collaborative framework** is a logical structure or model that classifies the various IK users and their structural relationships (local communities, scientists, managers and policy makers) and organizes the input and management of their IK using tools, methods and techniques. Collaborative frameworks provide a mechanism that guides users through a proper order of steps, applications, and data conversions via a common interface to the process being followed. It provides a unified view of the needs and functionality of each user thus allowing a coherent approach to the specification of the Collaborative tool as needed to realize the implementation of the tool (Li *et al.*,2005) [23].

The framework provides constant direction to the teams regarding why they are doing this work, what changes they can make, and how they can use measurement to determine if they are making changes that result in improvements. Collaborative frameworks have been used as solutions in various fields such as Health Management (Buchanan *et al.*,1988 [4]), solving problems in social interactions (Cai (2004) [19]), product development (Lihui, *et al*., (1998) [24]), Community Forest Management (Mendoza,*et al*., (2005) [25]) and supply chain management (Tah, 2004) [37].

According to Grenier (1998) [14] **Indigenous Knowledge** refers to the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographical area. Eyzaguirre, 2001 [11]defines IK as a type of knowledge that has evolved within the local (grassroots) community and has been passed on from one generation to another and encompasses not only local or IK but also scientific and other knowledge from outsiders. Obomsawin, 2002 [29] defines IK was local tacit knowledge that is unique to a given culture or society and forms the basis for local-level decision making. For the purpose of this research IK will be defined as knowledge embedded in the experiences of communities or local people and soft factors, including their beliefs, perspectives and value systems (Rahman, 2000 [32],Williams, 2002 [43]).

The development of IK systems, covering all aspects of life, including management of the natural environment, has been a matter of survival to the peoples who generated these systems. Such knowledge systems are cumulative, representing generations of experiences, careful observations, and trial and error experiments(Rahman, 2000 [32], Obomsawin, 2002 [29]).

A **Knowledge Management System** is a system that facilitates knowledge flow from the person(s) who know to the person(s) who need to know throughout the organization; knowledge evolves and grows during the process. Knowledge Management, while conceptually ancient is a relatively new form of collaborative computing. The goal of a knowledge management system is to capture, store maintain and deliver useful knowledge in a meaningful form to anyone who needs it anyplace and any time within an organization(Turban *et al.*, 2003) [38]. Knowledge Management systems are designed to manage knowledge creation through learning, knowledge capture and explicitation, knowledge sharing and communication through collaboration, knowledge access, knowledge use and re-use and knowledge archiving (Li, *et al*., (2005) [23] ,Turban *et al.*, 2003 [38].

Schreiber *et al.*, 2000 [33] defines knowledge management as a framework and a tool set for improving the organizations knowledge infrastructure, aimed at getting the right knowledge to the right people in the right time. The current IK stakeholders are structured in such a way that it encourages little knowledge sharing and whatever knowledge sharing is taking place is in unsystematic, informal way. Hence the need to develop a Framework that gathers catalogues stores and maintains knowledge to deliver appropriate IK solutions to anyone anywhere in the world who needs it (Schreiber *et al.*, 2000) [33].

In this research the knowledge management system will include modelling an organizational structure, identify the stakeholders, namely the knowledge providers (experts), the knowledge users and the knowledge decision makers, using appropriaate the appropriate elicitation techniques to acquire the appropriate knowledge, modelling the structure and nature of the knowledge involved and as well as the nature and structure of the corresponding communication and information sharing mechanisms and above all generating the technical aspects to support the system.

To summarize, **A "Collaborative Framework for Supporting Indigenous Knowledge Management"** is a model that classifies the various IK users and their structural relationships (local communities, scientists, managers and policy makers) and organizes the input and management of their IK using tools, methods and techniques. It also encompasses their interrelationships and provides a unified view of their needs. Tools and techniques will be activated to facilitate the implementation of the framework to ensure knowledge flow from the person(s) who know to the person(s) who need to know throughout the users to enhance systematic knowledge sharing.

1.2 Problem statement

World Health Organization (WHO) estimates that 80% of the worlds people rely on traditional medicine for Primary Health Care. In developing countries 70% rely on Traditional methods of Agriculture FAO Report, 2001 [12], yet there is very little work that has been done in the area of developing efficient indigenous knowledge management systems.

According to Obomsawin, 2002 [29], IK is tacit knowledge, difficult to codify and embedded in community practices, institutions relationships and ritutals. Grenier (1998) [14], Wolferson (World Bank, 2000 [44]) reports that "indigenous knowledge is an integral part of the culture and history of local communities. We need to learn from local communities to enrich the development process". Traditional development concepts and practices (industrialization, education) have failed to adequately address issues relating to poverty, disease and there is a need to

have alternative concepts to support the same. The marginalized communities forms a large percentage of communities in developing countries, it is the indigenous knowledge that has continued to sustain the marginalized communities in modern society.Recent research has generated more and more data and information showing the relevance of indigenous knowledge for sustainable development (Warren *et al.*, 1998 [42]), hence it is important for communities to record their own knowledge.

This data, however, must be systematically shared with fellow researchers and with practitioners, and research efforts can be stepped up further.

Currently a database of IK practices, lessons learned, sources, partners and methods of exchange are inadequate. There is also a need to Identify instruments for capturing and disseminating of indigenous knowledge and facilitate information exchange. There is a need to help build local capacity to share indigenous knowledge and Identifying appropriate methods of exchanging indigenous knowledge among and across local communities. In order to further enhance collaborations, management and utilization of IK, this research will focus on developing a collaborative framework and knowledge system for IK users (researchers, practitioners, policy makers).

1.3 Conceptual framework for IK sharing

The collaborative framework representing the various stakeholders, their requirements and relationships will be determined using the conceptual framework. It will also highlight the various forms of knowledge representation. The success of the Communication and collaboration depends heavily on the effective identification of all the stakeholders requirements since they all have different skills, backgrounds and objectives.

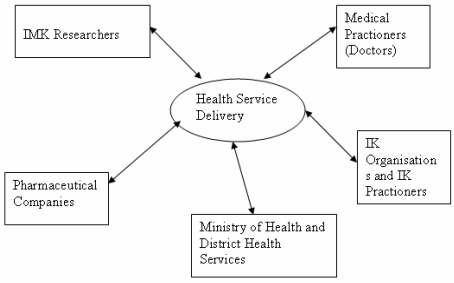

Figure 1: Proposed user's of the Collaborative Framework

1.4 Research aims and objectives

Aims

The main aim of this research is to develop a collaborative IK sharing framework that systematically classifies the various IK users, their structural relationships and organizes the input and management of their IK using tools and techniques.

Specific Objectives

The research is guided by the following specific objectives:

1. To identify the various factors that influence the successful sharing of IK.
2. Field Study that will develop Theoretical and conceptual Models of the Collaborative Framework.
3. Design conceptual collaborative framework.
4. Test, verify and validate the above using a case study of medicinal plants
5. Refinement of the tool and theory

1.5 Scope

In this research the knowledge management system will include modeling an organizational structure, identify the stakeholders, namely the knowledge providers (experts), the knowledge users and knowledge decision makers, modeling the nature and structure of the structure of the knowledge involved and as well the nature and structure of the corresponding communication. Above all generating the technical aspects to support the system. This research will focus on Human health indigenous knowledge and will aim at building a medicinal plants classification systems by integrating the knowledge offered by biomedical health practioners and the knowledge collected from Traditional Health Practioners (THP's). It will also include the use of herbal remedies in treatment of diseases; and locations of medicinal plants, the proper times for collection, the most useful parts, and the methods for preparing and storing medicines.

The research will focus on under the Natural Chemotherapeutics Research Laboratory under the ministry of health, Uganda which is at the forefront of research in biodiversity, particularly traditional medicine to demonstrate clinical efficacy, subsequently justify therapeutic use and it will also include the Traditional and Modern Health Practioners Association (THETHA) which is operational in sixteen districts in Uganda. However for the purpose of this research the same will be restricted to Two districts that is Bushenyi and Kasese.

1.6 Justification

Since the 1970s there has been growing interest in integrating traditional medicine into existing formal medical systems. In Uganda, like most sub-sahara Africa where there is a high burden of disease poverty, inadequate health services, there is a need to strengthen collaboration between traditional and conventional health practioners is a key strategy for expanding and improving health care delivery for the rural populations. This leads to a better understanding by communities of the practices and roles of both traditional and conventional medicine. There is also greater communication between the two systems, using knowledge gained by the traditional health practioners to build capacity at community level.

Collaborative frameworks have also been used in facilitating social interactions (Cai (2004) [19]) and civic participation by providing local resources online and by connecting people to local communication and discussion channels, public and non-profit organization leaders and members, and many other civic resources (Kavanaugh,*et al.*, 2005 [21]). They have also been successfully been applied to community forest management through Participatory modelling (Mendoza *et al.*2005 [25]). Participatory modelling is a general framework that subscribes to the principle that direct participation of local communities is deemed crucial to the success of any community development strategy. McMurray (2003) [30], develops a community collaborative online learning tool.

Current knowledge bases for IK that exist are a collection of IK practises, they have limitations in searching mechanisms and

knowledge representation to be able to satisfy all the individual users and due to different user requirements and understanding levels there is failed collaboration among the users. Information access is also very limited, problems of mutual suscipison among the collaborators, make constant update and maintenance to the same knowledge base very difficult.

There is need to help build local capacity to share IK among and across communities. In order to further enhance collaborations, management and utilization IK and to increase and improve the available information on IK, its collection and classification this research will focus on developing a collaborative knowledge management framework.

1.7 Significance of the study

This research will make significant contribution in two broad areas of scientific knowledge and

Social contributions in terms of;

i. Modelling of unstructured environments
ii. Collaborative frameworks for knowledge management
iii. knowledge elicitation and representation of tacit knowledge
iv. Ontology based Information sharing.
v. Knowledge preservation
vi Social development through job enrichment

Currently the collaborations between Traditional and biomedical health practioners is weakly structured hence there is a need to develop a model for the same collaboration. The model will identify the users and their user requirement and inputs and outputs.

Currently the capturing and sharing this intangible unstructured knowledge is informal and hence collaborative frameworks deal with the sharing of various interests and resources among various actors with the aim of reaching a common purpose. There will be significant contributions in the structuring and knowledge representation of highly visual information and combine it with highly structured knowledge from researchers.

IK is knowledge that is embedded in experiences of people and involves beliefs, in terms of novelty, the framework developed in this research will integrate tacit, informal, semi-informal knowledge by developing knowledge representation models.

In order to facilitate information access, sharing and re-use by the users of IK, an ontology based knowledge management system will be used.

According to Obomsawin, 2002 [29], IK systems are at risk of becoming extinct due to rapid changing natural environments and fast pacing economic, political and cultural changes on a global scale. Local practices vanish, as they become inappropriate for new challenges or intrusion of foreign technologies or development concepts that promise short-term gains or solutions to problems without being capable of sustaining them. Hence there is a need to capture scarce expertise in the area of IK and hence expand its use in remote locations. Social development is a learning process model and people occupy the centre stage of development as agents of change (Grenier (1998) [14];Obomsawin, 2002 [29]). The external agents such as development organizations play a facilitating role in helping people analyse their experience, i.e., as catalysts in the socialization, externalization, internalization and reconstruction of social knowledge through alternative communicative practices, as facilitators in the building of social institutions and culture that would provide the enabling environment for knowledge management (Obomsawin, 2002 [29]; Nonaka *et al.*, 1995 [31]). Oganizations is to work on models of participatory learning and organization that would help people engage in a continuous process of dialogue among themselves that would enable people to codify, externalize and universalize their knowledge. The diversity of IK has to be integrated into the global mainstream by harnessing latest Information and Communication Technologies (ICTs), for sharing ideas and experiences, mobilizing resources and support, advocating policy changes, and accessing resources and intelligence.

Formal collaborations of these communities will lead to job enrichment since most of the organizations will be formally registered hence enhancing their revenue and will also lead to protection of intellectual Property rights which is a big issue in the are of IK.

1.8 Research questions

1. What is the current Organizational structure? We need to develop an conceptual model that will include the major features of the collaborative framework. We need to analyze the inputs, the outputs, Preconditions and performance criteria, Required resources , Competences. We need to identify the stakeholders (establish their characteristics, behavior and user requirements) from the start namely: (a)Knowledge Providers (Experts): The specialists or experts in whom the knowledge of a certain area resides. (b) The knowledge users: The people that need to use this knowledge to carry out their work successfully (c) the knowledge decision makers: The managers that have the position to make decisions that affect the work of either the knowledge providers or the knowledge users.

2. What kind of knowledge elicitation Techniques are appropriate We need to establish all the sources of the information that you want to share. Due the heterogeneity of the users there is a need to address the appropriate knowledge elicitation.

3. What kind of knowledge Models are needed and how do we build them? With the different users and user requirements in mind there is need to come up with appropriate knowledge representation patterns. Hence we need to define conceptual data models. There is a need to establish data structures that can be used to analyze and exchange information.

4. How can we establish effective Information sharing? One of the benefits of the collaborative framework is information sharing and access. There is need to develop a structure for communication and develop information retrieval and information filtering mechanisms. The issue of intellectual Property rights is a big question as well.

5. What kind of tool is needed to support the collaborative framework and how do we build it? We need to establish how the knowledge will be implemented in a computer system or what tool will be used and the structure of the software architecture (language etc) and how the computational mechanisms look. Need to carry out Experiments with the above prototype. Need to validate the above theory by developing a Prototype.

6. How do we ensure knowledge Quality? The issue of knowledge quality is a very important issue hence we need to develop a quality assurance mechanism for the system.

2 METHODOLOGY

Collaborative Frameworks deal with the sharing of various interests and resources among various actors with the aim of reaching a common purpose. The basic goal is to provide a common language for the communication and collaboration among heterogeneous users that constitute the collaborative framework (Cai (2004) [19]). There are many challenges that must be addressed in the development of collaborative framework methodologies and architectures, these include Issues of communication, complementarily, compatibility, tacit ness, trust, protectiveness, and coordination must be explicitly recognized and integrated in the formation of collaborative frameworks (Yesilbas *et al.*,2004 [48]).

Knowledge Management requires a major transformation in organisational structure to create a desire to share (give and receive), the development of methods that ensure that knowledge bases are kept current and relevant and a commitment at all levels of a collaboration for it to succeed Hayder *et al.* (2005) [17] of which many of the above methodologies do not demonstrate. Despite their wide spread acceptance, collaborative frameworks have so far have often been criticised as lacking in rigor and in need of better structuring and analytical capabilities Johnson (2001) [20].

Collaborative frameworks are relatively complex and are therefore difficult to handle (Cai, 2004 [19]; Gertler *et al.*, 2004 [26]). They have the following components that distinguish them

from traditional organizations and learning situations;

1. Different level of expertise present in the community of practice

2. Level of Participation from the various users is critical success factor to the Model

3. User expectation, trust, conflict, and communication. However issues relating to structure of problems, facilitation and collaborative learning are emphasized.

It has been demonstrated, that one of the limitations of the current collaborative framework methodologies, is that the different expectations from the various users is an important perspective that has to be taken into account when designing collaborative frameworks (Hayder *et al.*,(2005) [17], Cai 2004 [19],Gertler *et al.*, 2004 [26]).

Communication gaps between the users is another methodology challenge, Buchanan *et al.*,1988 [4], Cai (2004) [19] describe a models of asynchronous collaboration between people with very

different knowledge of medicine in which a computer framework attempts to mediate between patients and physicians and reduce some of the differences in communication.

Trust and conflict are important issues relating to knowledge sharing within organisations Cai (2004) [19] . Hence there is a need to understand the framework and dynamics to trust and conflict within the content of virtual collaborations.

2.3 Proposed methodology

Based on the analysis of the above current approaches as demonstrated in 3.2 above, this research will use a combination of the following research methodologies as appropriate to be development of the collaborative framework;

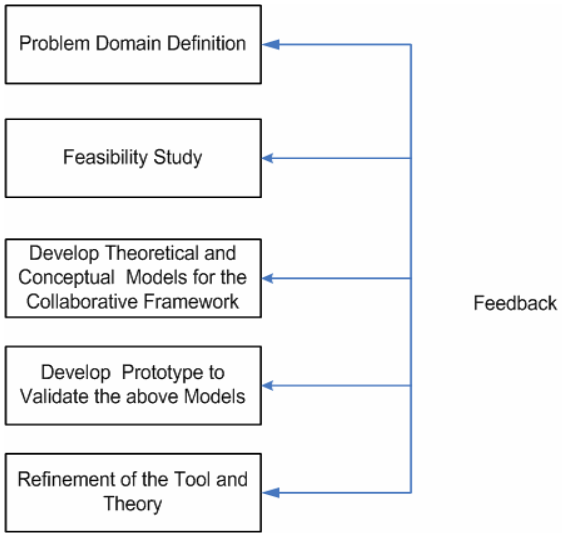

Figure 2: Proposed Methodology

1. To identify the various factors that influences the successful sharing of IK.
2. Field Study - To develop Conceptual model (Organisations, users, tasks) of the collaborative framework.
3. Develop a theory on and capture of IK using appropriate knowledge acquisition and elicitation Techniques.
4. Develop knowledge representation patterns or models for the IK captured above and develop a conceptual communication model of the collaborative framework.
5. Design the conceptual collaborative framework.
6. Develop a prototype to support the above models using appropriate tool
7. Test, verify and validate the above using a case study of medicinal plants
8. Refinement of the tool and theory

2.3.1 Problem Domain Definition

There is a need to determine the Research boundaries for the knowledge system using UML Diagrams.

2.3.2 Field Study

Any knowledge management system may only function satisfactorily if it is properly integrated into the organization in which it is operational. Many factors other than technology determine the failure of such a system. To analyze these factors, one must initially perform a feasibility study to first identify the problem / opportunity areas and potential solutions and secondly to put them in a wider collaborative perspective. Field studies and qualitative research methods will be used for Data Collection, will be to identify the People involved in the collaboration and be able to understand their requirements hence be able to focus on the domain for Ontology. The resulting data will also be used as the Focus for Conceptual Models. The collaborative framework representing the various stakeholders, their requirements and relationships will be determined using the conceptual framework aft. It will also highlight the various forms of knowledge

representation. The success of the Communication and collaboration depends heavily on the effective identification of all the stakeholders requirements since they all have different skills, backgrounds and objectives.

We need to establish all the sources of the information that you want to share. Due the heterogeneity of the users there is a need to collect the knowledge using appropriate knowledge elicitation.

2.3.3 Develop Conceptual Models for the Collaborative Framework

There is a need to analyze the global task of the knowledge system and hence develop a conceptual

model of all the tasks. It analyses the following;

1. the inputs

2. the outputs.

3. Preconditions and performance criteria.

4. Required resources

5. Competencies

This research will build conceptual models of the various users of the system by describing the characteristics of user, there requirements in particular their competences, authority to act, and

constraints in this respect. Further more it lists the communication links between users in carrying out a task.

The research will also develop knowledge models to explicate in detail the types and structures of the knowledge used in performing the above tasks. It will provide an implementation-independent description of the role that different knowledge components play in problem solving, in a way that is understandable for humans. This makes the knowledge model an important vehicle for communication with the experts and the users about the problem-solving aspects of a knowledge system, during both development and system execution Various users may be involved in a task, it is important to model the communicative transactions between the users involved. Hence a need to design a Communication model for the various users.

2.3.4 Develop Prototype to verify and validate the above models

The above will be seen to constitute the requirements specification for the knowledge system, broken down in different aspects. Based on these requirements, there is a need to establish the following needed to implement the above conceptual models

1 technical system specification in terms of architecture

2. Implementation platform.

3. tools to be used hence the Language (software modules, representational constructs and

computational mechanisms).

Various concepts, approaches and methodologies, useful for harnessing the traditional knowledge have been compared for ensuring access, benefit sharing and documentation of IK for sustainable socio-economic development and poverty alleviation in developing countries however the Ontological Knowledge Management methodology has not been enhanced.

There is need to develop an explicit formal specification of how to represent the IK, concepts, and other entities that are assumed to exist and the relationships that holds among them. Ontological knowledge management methodology solution using a de-centralized architecture is proposed. The IKM will constitute of

a framework of IK users who will consistently be using and reasoning about IKM related issues. The IKM will defines concepts and mechanisms that will allow the users to define, represent their knowledge and use it interactively. Since the knowledge that is represented will be familiar to all the individual users, collaboration and communication will be easy. This is implementable at low cost; the scalability increases in line with user numbers. Ontologys, rules and workflows are reusable and extendable.

2.3.5 Justification

1. Heterogeneous User requirements

2. There is a need for different knowledge representation formats as a result of different user

requirements

3. Dynamic nature of communication and Collaboration

4. Need for a Service Discovery Mechanism since the Knowledge is represented differently

2.3.6 Design Challenges

1. Language that will be used for Development of the Ontology

2. Tool that will be used for the implementation

In order to implement the ontology it is necessary to select a language capable to represent Sure(2004) [36], Grunbacher *et al.* , 2000 [13]) both the concepts of this ontology and its rules as well as an appropriate tool to assist its development. The criteria of language selection will be based on the capabilities of the ontology languages and these can be divided into two; the first one being the expressive ness of each language and the second one being evaluates the inference mechanism that each language may provide. Various traditional knowledge representing languages exist and these include ; CARIN, Flogic, KIF, Loom, OCML, OKBC and Ontolingua. However there are also web-based ontology languages likeXML (extensible Markup Language), SHOE, XOL, OML, RDF(Resource description Framework), OIL, DAML+OIL and OWL. Due to the locality of all the stakeholders the Language that will be adopted will be a web-based language.

A series of tools have been tested these include Apollo, LinkFactory, OilEd, OntoEdit, Ontolingua, Ontosaurus, Protg-2000,WebODE andWebOnto (Grunbacher *et al.* , 2000 [13],Sure(2004) [36]).These tools support merely the development of an ontology and do not provide services for merging, integrating annotating or querying Ontologys. In order to find the most suitable tool for the development of the ontology selection criteria was divided into the following categories; Criteria that describe the architecture of the development tool, criteria that expose the usability of a tool as well as interoperability with other ontological development tools and languages and finally criteria that valuate the capabilities of knowledge representation and inference of a tool. For example the criteria relevant to the architecture of a tool examine whether the its extensible an what

is its storage mechanisms. Additionally, the criteria that evaluate the usability of a tool examine whether a graphical interface is available and if the collaborative development of an ontology is permitted.

2.3.7 Refinement of the Tool to verify and Validate the Theory and Models using a Case study in Uganda

It is important to develop a valid and credible framework that will be able to meet the needs of all the users. Verification is the process of determining that the framework developed is a true

representation of the stakeholders requirements and that the tool developed performs as intended (Prunet *et al.* , 2003 [41]). Validation is process of determing whether the model developed is an accurate representation of the stakeholders collaboration (Prunet *et al.* , 2003 [41],Sure(2004) [36]). The evaluation phase serves as a proof for the usefulness of the developed ontologies and their associate environment. This will be able to check whether the target ontology fulfills the ontology requirements specification developed in the feasibility stage. The ontology will be tested in the target IK application environment. Feedback is very import at this stage.

The goal of the refinement phase it is closely linked with the valiadation and verification phase of the research(Sure(2004) [36], Grunbacher *et al.* , 2000 [13]. If the analysis of the the ontology in the validation and verification stage shows gaps or misconceptions, the results are used as an input for the refinement phase. It will be necessary to perform several iterative steps

3. ACKNOWLEDGMENTS

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