

## A Framework for Intra-Organizational Cluster Knowledge Management Based on Ontology

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**ABSTRACT:** The ability of an organization to share knowledge is viewed as a competitive advantage platform. A corporation must have processes in place to encourage and facilitate knowledge exchange inside the organization in order to acquire this advantage. The key elements that influence employees' knowledge comprehension are organizational and individual characteristics. A knowledge-based system called ontologies is required for personnel to properly cooperate and exchange knowledge. Ontology will provide innovative problem solving for searching and sharing their knowledge and experience by creating a cluster within the organization through the implementation of a search mechanism for effective communication. This paper is aimed at investigating the emerging technology of Semantic Web and Ontology to design Ontology-Based Knowledge Management System (OKMS) for intra-organization that will support knowledge management activities. This was accomplished by establishing a cluster inside the organizational structure that will allow for unfettered information flow throughout the group of firms, boosting effective communication among the company's employees and optimizing profit. The modified waterfall model was used to create the system. The result demonstrates how learning, unlearning, relearning, and reflection are used to get the right knowledge to the right people at the right time, as well as assisting people in sharing and utilizing the information, developing and reflecting previous experiences, and practices for sharing knowledge to improve organizational performance and develop core-competencies. As a result, it's critical to comprehend the types of information exchanged and how an organization's expectations impact knowledge sharing among its members.

**Keywords:** *Intra-Organizational*, cluster, Cluster Knowledge Management, ontology, architecture, centralization, decentralization.

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## INTRODUCTION

The Organizations have long seen knowledge as a strategic asset and a source of competitive advantage. It is an important organizational asset that provides value to the company's products and services. It is made up of the perceptions and understandings that provide meaning to the information and data available to the organization. Tacit and explicit knowledge are the two categories of knowledge that are fundamental to Knowledge Management. It is critical to promote the exchange of both tacit and explicit knowledge among employees inside the company (Syed-Ikhsan, 2004). Tacit knowledge (experience-based knowledge) is personal, intelligent, beliefs, ground truth, judgement, values, and is difficult to define, document, or communicate. It is frequently considered as the true key to getting things done and producing new value. While explicit knowledge (knowledge gained from others) is information that can be codified, articulated, abstracted, and transferred across time, implicit knowledge (knowledge gained from others) is knowledge that cannot be codified, formulated, abstracted, or transmitted across time. The most valuable and important resource of an organization is the knowledge generated and utilized in the mind of the knower. A knowledge-intensive economy's ideal success is entirely dependent on it by how successfully businesses collect, use, and use knowledge. To increase competitiveness and innovation, many companies actively assist their employees' productivity by upgrading their 'know-how' and experiences. Knowledge is characterized as a vital component of Knowledge Management; without understanding how to manage, Knowledge Management would be impossible (Baloh, 2011).

Knowledge Management (KM) is a combination of ideas, procedures, organizational structures, and technology that enable employees to exchange and exploit information in order to achieve their goals. Because of its ability to bring strategic benefits pertaining to profitability, competitiveness, and capacity to companies, knowledge management has piqued attention in business and management circles. Knowledge management is often emphasized as an important and vital component of organizational survival and competitiveness (Koh, 2011). It will thus be recognized as having been successful as a consequence of information-sharing by putting that knowledge to even better use. To achieve an effective and successful KM, firms must include KM into their entire plans as well as part of their objectives. Organizational concerns are significant in Information Management study because they enhance collaboration and knowledge exchange between firms.

Clusters are described as geographic concentrations of interconnected enterprises and institutions in a certain industry; they may also be clusters of interconnected industries that drive wealth development in an area, especially via the export of products and services. Cluster collaboration allows for the optimization of engineering and manufacturing processes as well as the reduction of non-manufacturing costs for cluster members. As a result, all members of the cluster get additional competitive advantages. Another item to consider is that cluster collaboration drives innovation, fosters advanced technologies, and promotes information sharing. By routes of suppliers and

customers, there is free information interchange and rapid novelty spread. During the growth of a connection, many members in clusters overcome differences and latitude. However, the heterogeneity of information, particularly the semantic aspects from various information systems, poses a new issue (Lambrix, 2005). The notion of ontology is proposed to describe information in a not only basic but also abstract fashion in order to overcome this challenge and take semantics representation into consideration. Ontology has been regarded as a suitable technique for a wide range of knowledge management operations, including retrieval, storage, sharing, and dissemination. Ontology also establishes a shared and common knowledge of a topic that can be shared among individuals and application systems. This was mirrored in the work of (Ying D., 2005), who argued that one method for enterprises to survive in today's tumultuous business climate is to develop strategic alliances or mergers with other businesses that are comparable or complimentary. The research focuses on developing an ontology-based knowledge management system that will enable the company to move away from not sharing their knowledge and collaborating with other companies to cluster together, provide a free flow of information among the group of companies, and improve effective communication among company employees, all of which are necessary for profit optimization.

## **THEORETICAL REVIEW**

### *CLUSTERS ON ORGANIZATIONAL AND KNOWLEDGE MANAGEMENT*

Ontologies have created a considerable amount of scholarly interest in a short period of time, as indicated by the literature.

The use of ontologies for the integration of diverse information sources (H. Wache, 2001) article described how ontologies are used to facilitate integration tasks. They compared and assessed the languages used to express ontologies, as well as the usage of mappings across ontologies and the connection of ontologies to data sources. They assessed their findings by summarizing the current status of ontology-based information integration and identifying topics for further study. According to the findings of (Mohammad Fiaz, 2015) study, information knowledge management exercises boost an organization's performance. When people want to improve their company performance, they should improve their organization's information management activities, which will result in an increase in the firm's development capacity and performance. Without information management, businesses are always reinventing the wheel, however learning management ensures that businesses can influence their present learning resources to be innovative and market leaders.

However, (Abirami, 2013) created a number of semantic web apps that transform unstructured or semi-structured material into XML/RDF format for machine analysis. The method allows for fast conclusions and the finding of new information from a collection of data.

Furthermore, (Holdt, 2000) argued that each situation of exchange has different assumptions about individual behavior and the intermediaries that regulate the exchange, and that facilitating knowledge sharing should be seen as a continuum

of practices influenced by opportunistic behavior, obedience, or organizational citizenship behavior. They established a three-stage ontology life cycle for ontology engineering in their study (Sergey S. A. 2006). They created a metal industry ontology, arguing that ontology should be approached from two perspectives: information ontology and domain ontology. Dublin Core was chosen as the information ontology because of its suitability for representing knowledge objects. In a genuine case study of the metal industry in Taiwan, a framework of ontology-based knowledge management system was suggested, and a prototype for supporting knowledge management was constructed. For the reasons of flexibility and robustness, the system was developed on the Java J2EE architecture, and it used the KAON API to interface with the KAON service for maintaining information ontology and domain ontology.

Also discussed was an ontology-based mechanism for matching projects with subject experts (Wu, 2012). They created a system prototype with four modules: ontology creation, document formalization, similarity computation, and user interface. They addressed the node-based and edge-based techniques to computing semantic similarity, and proposed an integrated and enhanced method for calculating semantic similarity between two papers. The results of the experiments suggest that our ontology-based KMS for project and domain expert matching may achieve higher recall and precision.

(Nisanart T, 2015) used the ontology approach to create knowledge of cultural tourism information in the Dusit area. They began their investigation by compiling a list of all difficulties and issues that will be employed in the system. In their initiative, they made ontology the centre of knowledge creation. The system's performance has been praised by both professionals and users.

However, (Kuo-Wei Su, 2016) explores a knowledge management model of aviation control by analyzing the aviation organization architecture, including information transmission methods and key knowledge assets, from the perspective of departure processes. It investigates how the Common KADS technique transforms explicit information using the Common KADS sheet and the Unified Modeling Language (UML) graph presentation and ontology model.

(David k., 2015) investigated the information shared among participants in the SEVS (Safety, Efficient Vehicle Solutions) project, as well as the variables that may influence knowledge sharing. They devised three research topics in order to complete his thesis. The first study question comprises characterizing knowledge sharing in an open innovation collaboration, which established the ground work for the other two research questions, which are concerned with determining the facilitators and impediments to knowledge sharing in an open innovation project.

Van Der Meer's, 2013 work brings together local knowledge and skills while also bridging the gap between government and industrial entities. They were interested in learning how information is exchanged between organizations. They investigated the knowledge sharing implications of mixed membership, multilevel interaction, and the requirement to cross borders with other organizations in these partnerships using interviews, observations, and social network analysis.

## METHODOLOGY

The Organizational Cluster and Knowledge Management approach is used to manage and regulate resources in order to meet certain objectives. The purpose of this research is to create an ontology-based knowledge management system for businesses, especially the Dangote Group. We begin the work by reviewing literature in various fields in order to select a research topic. The research topic was selected in conjunction with a case study.

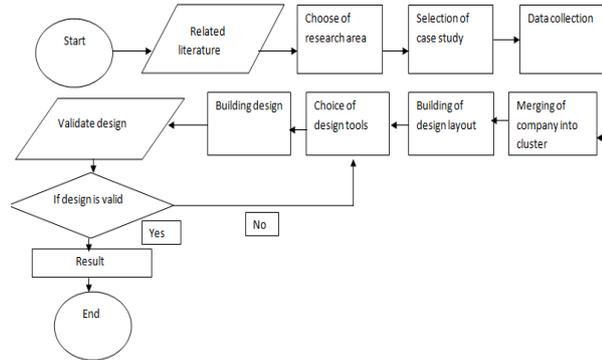


Figure 1. Proposed Research Methodology

Looking at the many corporations in Africa, with Dangote being the largest in West Africa and one of the largest on the continent, each department manages its expertise within its department, with no collaboration among the employees. As a result, we researched the firm and gathered all of the necessary information. The intra-organizational cluster of the company's knowledge sharing structure was separated into four clusters based on the criteria of their production technique. Manufacturing, Milling, Management, and Refining are the departments.

The design tools have been selected, and the design will be constructed. We shall terminate the paper if the design is valid; else, different design tools will be picked.

### THE ORGANIZATIONAL MODELING USING ONTOLOGY

For the Dangote group of firms, a framework for an ontology-based knowledge management system was presented. The framework's architecture is depicted in Figure 2. The life cycle of ontology design, according to (Kayed, 2001), may be described as three key stages: creating, manipulating, and maintaining. We define the aims, scope, and needs of ontology during the construction stage. After all needs have been defined, data and information about the group of enterprises may be collected. The next stage is to examine the data and information gathered. The ontology may be separated into information ontology and domain ontology based on the examined ontology. In the ontology implementation process, this generates the information and domain ontology.

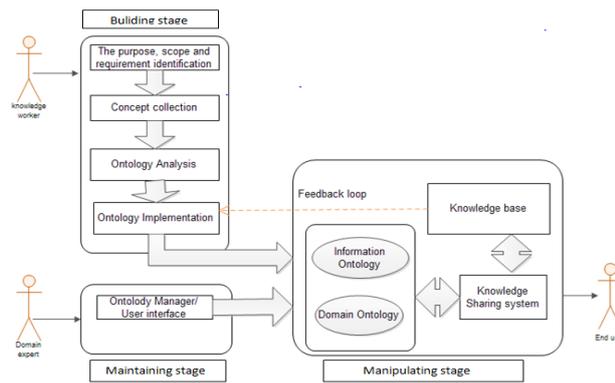


Figure 2. The framework for ontology-based knowledge management system

The information ontology defines knowledge objects and comprises general concepts and characteristics for all information about knowledge objects, which can be an electronic file, a database record, or a problem solution, among other things. The domain ontology is made up of the company's ideas, characteristics, and instances. When searching for knowledge items, domain ontology is used to accomplish the goal of semantic match. When an end-user accesses the knowledge base, the ontology is delivered to the knowledge management system at the manipulating stage and supports knowledge management activities and searching. Between the knowledge base and the ontology, both ontology analysis and ontology implementation, there is a feedback loop. The feedback loop gives the potential of extending information ontology as more and more different types of knowledge items are added to the knowledge base. Domain experts can add, edit, and delete ontologies through the user interface during the maintenance stage.

#### THE PROPOSED ONTOLOGY-BASED KNOWLEDGE MANAGEMENT SYSTEM FRAMEWORK

This part explains the design technique for the preceding section's ontology-based knowledge management system. The research's main goal is to solve a problem, and the results of the questionnaire and interviews assist us in gathering the information needed to construct the system's design layered architecture. The outcome will aid organizations in collaborating and supporting knowledge management operations inside the organization for free flow of information within the group of firms, as well as improving effective communication among corporate employees to maximize profit.

We go over the proposed system's design in great depth. The system's design layered architecture is depicted in the diagram below, which is made up of three layers: Presentation Layer, Business Layer, and Data Layer.

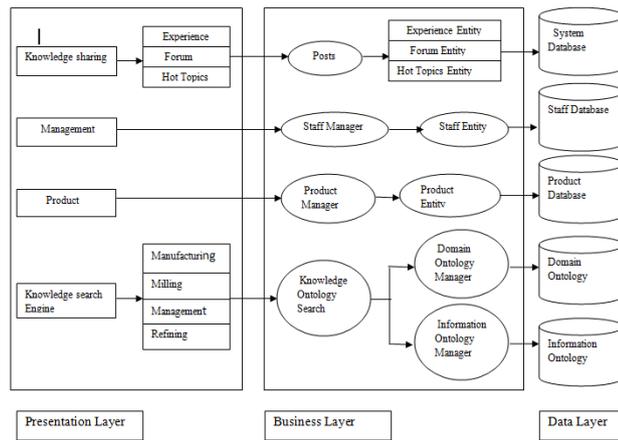


Figure 3. Design Layout of the Proposed System

## RESULTS

### MAIN LOGIN PAGE

This is the main page for all system users; it is the first page personnel must view to access the search box and conduct information searches. To utilize all of the features available, the employee must enter his user name and password. His/her user name is his/her staff ID, and the password is emailed to him/her by the admin.

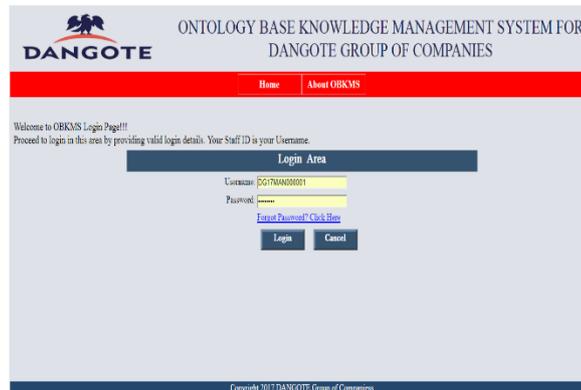


Figure 4. Main login page

### ADMINISTRATOR PAGES

#### Home Page

On this page the Administrator view the message sent to him which he didn't respond to.



Figure 5. Admin home page

*Add New User Page*

This is a page where the admin adds new user (new staff), the user's details are stored and his/her user ID and password are sent to his/her email.

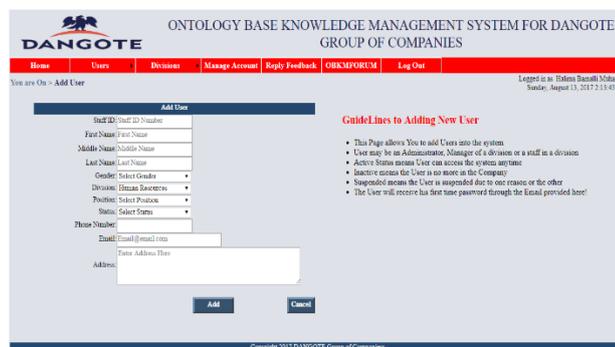


Figure 6. Admin's page for adding new user

*MANAGER PAGES*

*Manager Home Page*

This page allows the manager to view reply to his messages he sent to Admin.

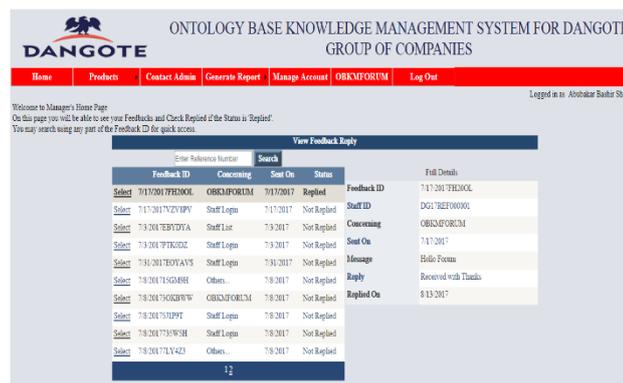


Figure 7. Manager Home Page

*Generate Staff List*

This page function allows the Manager to generate the staff or product list belonging to his division. The list is generated based on the year the staff joined or the products are added.

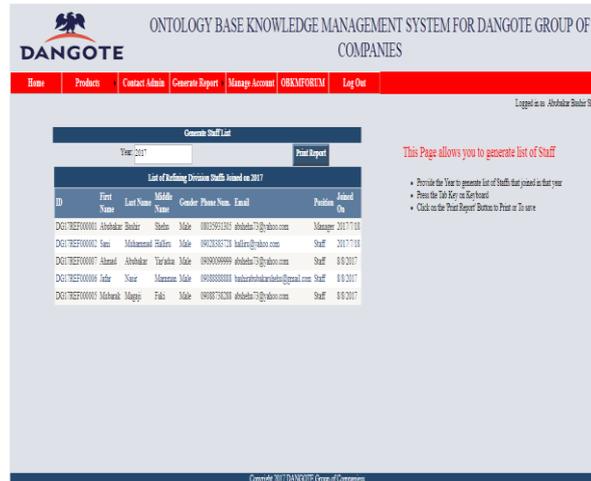


Figure 8. Generate Staff List

## DISCUSSION

The aim of this research is to create an ontology-based knowledge management system for businesses, especially the Dangote Group. A framework for intra-organizational cluster knowledge management based on ontology which is supported by the following objectives;

- To solve a problem, and the results of the questionnaire and interviews assist us in gathering the information needed to construct the system's design layered architecture.
- To create a cluster within the organization by implementing a search mechanism for effective communication.
- To design an ontology-based Knowledge Management system that allows users to solve innovative problems by searching and sharing their knowledge.

## CONCLUSIONS AND RECOMMENDATIONS

Web-based knowledge searching and sharing systems are becoming increasingly significant as network technology advances. However, the arrangement of searching and distributing material varies widely depending on the application area. The system's goal is to: (1) analyses the system's requirements by studying the company's information; (2) create a cluster within the organization by implementing a search mechanism for effective communication; (3) design an ontology-based Knowledge Management system that allows users to solve innovative problems by searching and sharing their knowledge; and (4) verify the proposed design by the company's staff, who will then appraise the system. The stated objectives were compared to current literature in several fields in order to identify a research gap, and the study area was selected.

Given Africa's enclave of unique enterprises, and Dangote Group's position as the largest company in West Africa and one of the largest on the African continent, the company has the ability to play a leadership role in information management for associated companies' effectiveness and efficiency. Decentralization of information or knowledge would result in a knowledge gap among clustered workers. Based on the parameters of their production

segmentation, the firm under investigation is classified into four groups. As a result, the design tools are picked and constructed. For this paper, ontology was considered to be at the centre of knowledge creation. We discovered that each department stands alone after conducting interviews and questionnaires with the company's employees. Because there is no ontology, there is no cooperation, searching, or exchange of knowledge among the group of enterprises. The results of the model development reveal that the employees are happy with the system's performance and that they are eager to provide the needed information.

### **FURTHER STUDY**

The findings of this research might provide crucial information for future research on inter-organizational knowledge exchange. Also companies with different branches from other local governments or areas needs to be handled in future research.

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