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Knowledge Management in GIS for Logistics

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ABSTRACT: The Knowledge based theory of the Organization suggests that the Knowledge is the organization key intangible asset, while value creation depends on the leverage of the intangible assets of the organization. Knowledge management systems are emerging to sustain in hyper competitive market.
"Knowledge management deals with how an enterprise gathers, organizes, shares and analyzes the knowledge of individuals andgroups across the organization in ways that directly influences organizational performance"
This paper attempts to study the framework of Knowledge management systems, practices followed, tools and metrics implemented in organizations which benefits implementing knowledge management systems, It also lists the challenges encountered. knowledge obtained from knowledge management systems has to be integrated in to different applications for business has to be competitive and to remain at competitive advantage; decision making has to be faster, reliable and timely.
The decisions are becoming increasingly dependent on understanding and coding complex information obtained from knowledge management systems and GIS (Geographical Information Systems)technology is able to incorporate this requirement. Different applications of GIS - like logistics are implemented in organization by using Information Technology.
Geographical Information Systems is computing application capable of creating, storing, manipulating, visualizing, and analyzing geographical Information. It finds its application in transportation management, vehicle routing and parcel delivery, logistics and many logistics activities like site selection, location analysis, and transportation are inherently related to geographic knowledge. Therefore Geographical Information Systems is powerful analytical tool that can be widely applied to logistics management.

Keywords: Knowledge Management System, Geographical Information System, Logistics, routing, site selection.

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I. INTRODUCTION

The organization of the paper is as follows. The first section of the paper gives an overview of Knowledge Management Systems, its challenges, benefits, tools and metrics used by organizations. Section two briefs about knowledge as a tool for GIS and third section highlights an application of GIS namely logistics.The business landscape is marked by faster pace of innovation, an internetworked organizational structure, a focus on intellectual capital, and an increasing employee churn rate. Knowledge Management is being interpreted as a critical discipline for risk management, decision making increasing productivity, Knowledge retention and more efficient innovation.

According to IDC estimates, approximately 3.2% of corporate knowledge is incorrect and becomes obsolete every year. An estimated 4.5% of Knowledge is lost or hidden due to employee turnover, Information mismanagement, and knowledge hoarding.These problems can be resolved by properly aligning content management systems, policies and knowledge work.Knowledge Management practices have been at the core of the most successful IT firms. Global IT firms are leveraging Knowledge Management to capture best practices, improve project management,nurtureinnovation ,enhance customer service, reuse software code and expand across boundaries of technology generations and varying maturity levels of market, content management, groupware, online communities of practice, enterprise portals,e-learning and wireless tools for Knowledge mobilization.

Knowledge Management Systems are tools to effect the management of knowledge and are maintained in a variety of implementations including repositories expertise data bases, context specific retrieval systems, incorporating collaborative filtering technologies.Knowledge is a complex concept and is categorized in to two as tacit knowledge /implicit knowledge or explicit knowledge. It can be conceived as existing in multiple levels - individual and at a group and at organization level.Organizational knowledge is created through cycles of combination, internalization, socialization and externalization that transform knowledge between tacit and

explicit modes. The dynamic process of knowledge creation requires linkages between individual and group sharing and therefore communities of practice play an important role in knowledge sharing.Knowledge sharing is executed in two methods when building Knowledge Management Systems - personalization and codification. The personalization strategy recognizes the tacit dimension of knowledge assuming that knowledge sharing is through interpersonal communication. Codification knowledge transfer is through document to personal approach where knowledge artifacts are stored in databases which when mined enables the correct retrieval of information.

Knowledge Management Process And Implementation

A practical 10 steps guide in 4 phase roadmap has been proposed by [1] that includes

- Infrastructure evaluation
- Knowledge Management system analysis, Design and development
- System development
- Evaluation

Seven knowledge management processes have been proposed by [2] each with sub process.

- Develop(acquire, capture, create)
- Apply(use, execute)
- Assess(appraise, evaluate, validate and verify)
- Preserve(store,secure,retain)
- Update(evolve,improve,maintain,deploy,disseminate,share)
- Transfer(communicate)
- Transform(compile,formalize,standardized)

Any approach to development can be adopted by organization but critical success factors have to be evaluated for successful implementation of KMS. Considering the complex nature of knowledge four enablers that act as a critical success factors of knowledge management identified are leadership, culture, technology and measurement. Technology is employed in all the process of Knowledge Management and various technology solutions are available in market. Effective use of technology depends on how well the technology fits the process it supports. [24] Provides a map for selection of technology.

[1] Suggests that target Knowledge Management objectives to technology. For example if the organizations objective is to locate knowledge and their knowledge base then search and retrieval tools and yellow pages would be technology enablers. If the objective is to create knowledge, then collaborative decision making, expert systems, Decision support systems, data mining systems, externalization tools would be useful. For reusing knowledge communities of practice would be used. New titles and positions are created to make the best of organizations knowledge capital. One of the biggest hurdles in implementing Knowledge Management successfully is to address cultural change issues. The duty of the CKO is to ensure the knowledge sharing occurs in full, between individuals and organization. This sharing is successful only when the knowledge value is rich for the knowledge sharers. If it is less or mismatch value between the two, knowledge sharing is unsuccessful , resulting either in hoarding of knowledge or selective sharing. If the employees objectives are not synchronized with that of the organizations or vice versa then Knowledge Management Systems implementation becomes difficult. Therefore organizations must be employee oriented and should favor open communication and thus the job of CKO is crucial for successful implementation of Knowledge Management Systems.

Issues and challenges related to the utilization of IT for Knowledge Management support can be in three phases of deployment.

- Setup Phase
- Ongoing utilization
- Maintenance phase

Metrics for Knowledge Management System [5]

In a time of economic slowdown measuring ROI (return on investment) in initiatives like knowledge management is becoming a pressing concern today. According to Bruce Richard of HP Consulting “The Knowledge Management process must take into consideration the needs of all stake holders" Knowledge Management measurement at HP is at multiple levels-process, role, people, organization, customer satisfaction through measures including frequency of contributing, sharing, customer satisfaction through measures including frequency of contributing, sharing or reuse of project materials.Johnson and Johnson uses tool “Knowledge Networking Environment Assessment Tool (KNEAT) to access Knowledge Management environment via surveys about leadership, Individual behavior, IT tools and peer behavior.

At Siemens, metrics for successful ROI include a number of requests to knowledge base, increase in orders, reusable R & D components, and reduction in labor costs, production cost, lower training expenses and reduced IT investments.
Knowledge Management metrics are classified into 5 categories depending on their Focus: technology, business process, knowledge, employee process, business process. KM metrics can also be classified by their nature as quantitative, qualitative and semi quantitative. In some, KM metrics will continue to be a major factor in Knowledge Management tool deployment in many organization and debates over its accuracy and choice of the metrics will continue.
Benefits of Knowledge Management Systems

- Improved team communication
- Consistency of data and reduced problem solving time
- Improved project management
- Customer participation
- Business process improvement through implementation of technologies like GIS
- Operational efficiency increases
- Organization becomes innovative in terms of products and services and therefore it becomes a learning of organization.

Challenges in KM implementation
Challenges in KM implementation can be divided into 3 types, culture, technology infrastructure and process and architecture.
Culture: management support and sponsorship
Demonstrating business value
Change management implementations
Keeping pace with new technology
Security

Technology: integrated database
Inter-operability
Navigation tools
Process and architecture: business process model
Documentation
Integrating into planning system
Execution
Measurements
Metrics

It has been observed that 80% of business data has a geographical element, and hence GIS play a very important role. It provides an extremely powerful tool to integrate and interpret diverse datasets such as social and population data, administration boundaries, topography, land use, and resource locations, and to explore the relationship between these through a variety of different views and analyses.Geographical Information System is computing application capable of creating, storing, manipulating, visualizing, and analyzing geographic information. It finds its application in transportation management, vehicle routing and parcel delivery, logistics and many logistics activities like site selection, location analysis, and transportation are inherently related to geographic knowledge. Therefore Geographical Information System is a powerful analytical tool that can be widely applied to logistics management.Geographical Information System is a collection of computer hardware, software and geographic data for capturing, managing, and displaying data. Geographical Information System is a description of objects with location, share data and attribute data combined together. The following basic components define the architecture of Geographical Information System namely

- Hardware : it could be stand alone with a central workstation or client-server architecture
- Software : GIS application package to perform all the required functions
- Databases : it is the backbone of the knowledge stored in Geographical Information System. A geographical database tied to other data bases like relational database
- People : they are essential to GIS process because they can analyze spatial information and received from GIS

Each component can contain temporal information and can become the part of reproducible temporal processing of sequences of DB objects. [7]. Every geographic (spatial) object has many characteristics. They can be classified into types of data : spatial data and non-spatial (attribute) data. Spatial data include the object's

location, length, size, height, and its spatial relationship with other objects (adjacency, containment, and etc). Non-spatial (attribute) data include the name, owner, land use type, and many other characteristics of the Object. GIS software packages provide support for both spatial and attribute data of geographic objects. In GIS, spatial data are represented in raster or vector format. In raster representations, a raster cut up the study space into square cells, and assign a value to each cell. In vector representations, geographic phenomena are explicitly associated with geo-references which are coordinate pairs from some geographic space. The representation of geographic objects is more naturally supported with vectors. In vector representations, geographic objects are represented as points, lines, and areas.

GIS applications are frequently used in producing new information by combining information from different sources present in the databases. New information technology of GIS in data processing together with decision analysis techniques promotes new styles of knowledge communication and utilization.

Geographic information technology is becoming an integral part of the information infrastructure in many organizations. The unique integration capabilities of a GIS allow disparate data sets to be brought together. GIS technology is used via internet and web services. The business intelligence systems bring GIS, marketing analysis tools and demographic data products to offer powerful ways to compete in business strategies. GIS provides solutions that lead to better business decisions.

GIS finds its application in transport management, vehicle routing parcel delivery, and logistics. Many logistics activities like site selection, location analysis, and transportation are inherently related to geographic knowledge. Therefore Geographical Information System is a powerful analytical tool that can be widely applied to logistics management.

Organization depends on their logistics system to move materials, goods, equipment, and people within and among supply chain partners. It uses knowledge present in the knowledge base which is continuously updated by knowledge management system. Logistics covers wide range of functions like Transportation, warehouses etc. GIS has been employed to find a solution for many business related questions in logistics such as the best route for data / material to be sent, schedule of deliverables, number of mobile resources available, optimizationfor service delivery and minimize costs, site location.

A typical logistics systems consists of several elements such as customer service, demand forecasting, distribution communication, inventory control, material handling, order processing, packaging, parts and service support, plant and warehouse site selection, purchasing, location analysis, return goods handling, salvage and scrap disposal, traffic and transportation, and warehousing and storage.

The use of GIS in logistics commonly takes place in three phases: data entry, data analysis and data presentation. The most distinguishing parts of a GIS are its functions for spatial analysis, i.e., operators that use spatial data analysis is to derive new geo information. The principal objective of spatial data analysis is to transform and combine data from diverse sources into useful information, to improve understanding or to satisfy the requirements or objectives of decision-makers. Major functions that are possibly useful for logistics are

- Retrieval functions allow the selective search and manipulation of spatial and non-spatial data without the need to create new entities
- Measurement functions allow measuring distances, lengths or areas
- Overlay functions belong to the most frequently used functions in a GIS application. They allow combining two spatial data layers by applying the set-theoretic operations of intersection, union, difference, and complement using sets of positions (geometric attribute values) as their arguments.
- Search functions allow the retrieval of features that fall within a given search window (which may be a rectangle, circle, or polygon)
- Proximity functions (buffer zone generation). This function determines a fixed-width (or variable-width) environment surrounding a given feature.
- Connectivity functions accumulate values as they traverse over a feature or over a set of features.
- Network analysis is used to compute the shortest path (in terms of distance or travel time) between two points in a network (routing). Alternatively, it finds all points that can be reached within a given distance or duration from a center (allocation).

ArcView software is available in the market to perform all the Logistics Functions.

II. CONCLUSIONS

Knowledge Management initiatives in organizations are becoming important and organization are making large IT investment to apply Knowledge Management Systems. The focus of these organization is to develop new applications of IT such DW and document repositories linked to search engine to capture the knowledge, storage and retrieval of organizations knowledge. GIS technology can be user friendly, because knowledge integration with database has become very easy with reduced cost of computing, increased

availability of digital map data, software available and with the usage of internet. Customized software can be developed to implement logistics in organization, with GIS technology, if knowledge databases are available for integrating knowledge bases with GIS applications, highly expert-people must be available in organization and continuous education and training of people are required. For this to become easy, employees and organizations goals/objectives and value of knowledge for both should be the same. If the employees objectives are not aligned with that of organizations and vice versa then Knowledge Management Systems implementation becomes difficult. Therefore organizations must be employer oriented and should favor open communication and thus the job of CKO becomes very important for successful implementation of Knowledge Management Systems.

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