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Formalization of Digital Knowledge And Modern Approaches to Data Management

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Abstract.

Effective management approaches involve the utilization of formalized knowledge acquired within the organization and subsequently the deployment of decision support systems to facilitate decision-making. For the formalization of knowledge accumulated within organizations, it is necessary to explore the forms of formalization of data. To effectively develop good knowledge bases, a good knowledge representative is needed. Let's discuss the aspects of knowledge representation in the context of semantic web using as an example. However, it is possible to add or maintain a lot of complex data. There are some common views of date storage. Document System, Database oriented a subject, Relational database, Object relational database.

Choosing a programming language for a knowledge management system involves considering additional components, such as: Flexibility, Simplicity, Efficiency, Expansion, Support, Portability, Reliability.

Various types of knowledge representation logics are utilized, including : Propositional Logic (PL), First-Order Logic (FOL), Higher-Order Logic (HOL), Modal Logic, Fuzzy Logic, Multivalued Logic, Temporal Logic, Description Logics (DL), Frame, Rule-Based Systems.

Regardless of the type of organization, the system of using tools simplifies the formalization and representation of its knowledge, which forms the basis for fast and efficient management.

Keyword: Digital knowledge, Formalization of knowledge, Digital management, knowledge management system

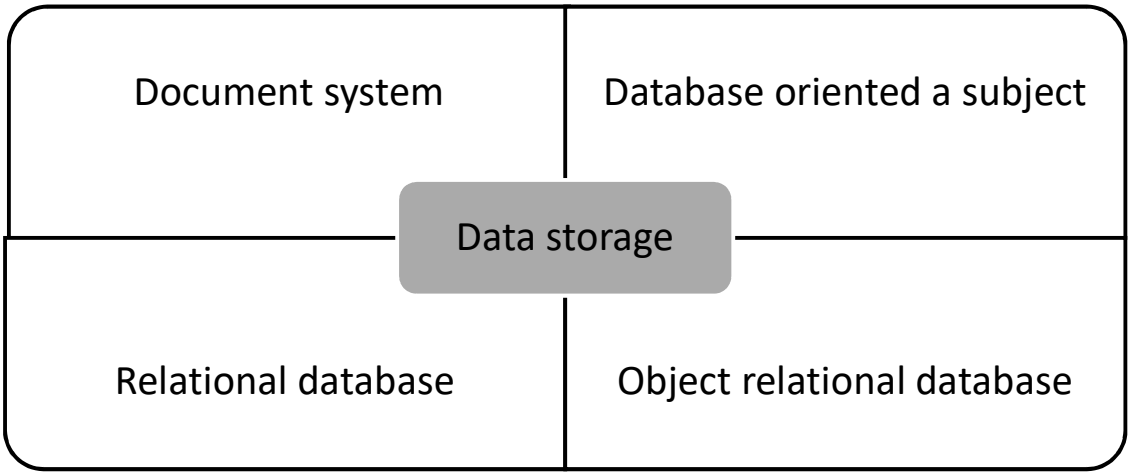
In modern world success of an organization is dependent on its Effective management methods, which is impossible without swift and well-informed decision-making skills. This is achievable only with rapid and effective implementation of knowledge accumulated within an organization. Thus, effective management approaches involve the utilization of formalized knowledge acquired within the organization and subsequently the deployment of decision support systems to facilitate decision-making. For the formalization of knowledge accumulated within organizations, it is necessary to

explore the forms of formalization of data. To illustrate the above mentioned in an example we can refer to knowledge bases systems which accumulated facts, procedures, meanings, etc., Databases help us find specific answers to questions, which are needed to address specific problems. Knowledge representation is the method of encoding knowledge, allowing us to depict goals, actions, beliefs, reasoning, and psychological states within knowledge bases. Semantic web pages define standards for interoperable knowledge bases. To effectively develop good knowledge bases, a good knowledge representative is needed. Let's discuss the aspects of knowledge representation in the context of semantic web using as an example. It has been many years, since numerous scientists discuss about the distinction between the data, information, and knowledge. Some authors argue that data is the representation of a process, information is the representation of information, and knowledge signifies the representation of knowledge through the different perspective.

For example, the fact that "New Delhi" is the capital of India this would be data before it is stored in a database, this fact will become information when a person states it and transforms into knowledge when someone knows that New Delhi is the capital of India.

Data bases are classified into relational or non-relational databases.

Relational databases provide an in-memory mechanism and make it possible to move/use data without having to perform a join operation. However, it is possible to add or maintain a lot of complex data. There are some common views of date storage.



- **Document System**-is the system designed for simple data and does not require querying of data.
- **Database oriented a subject**-database that describes and provides information about a specific object. It is connected to complex processes of data and does not require querying of data.
- **Relational database**-is a subject-oriented database in which the data is structured, but it lacks the capability to store multimedia content such as photos, audio, or video materials.
- **Object relational database** - This is a complex database that includes data corresponding to data requests. However, its cost is relatively high.

Not all databases provide the ability to search for information semantically. The semantic search functionality of databases depends on the representator of knowledge. How thoroughly knowledgeable data is entered into the database and what type of knowledge search is preferable for the representator [1].

In the rapidly evolving landscape of logistics, the formalization of digital knowledge and the adoption of modern approaches to data management have become pivotal for achieving operational efficiency, cost-effectiveness, and enhanced decision-making processes. This paper explores the intersection of digital knowledge formalization and contemporary data management strategies within the context of logistics processes.

The formalization of digital knowledge refers to the structured representation and organization of information in a way that facilitates automated processing and meaningful analysis. In logistics, this involves the integration of diverse data sources, such as supply chain information, transportation data, and inventory records. This paper delves into the methodologies and frameworks for formalizing digital knowledge, emphasizing the role of ontologies, semantic modeling, and knowledge graphs in creating a unified and interoperable knowledge representation in the logistics domain.

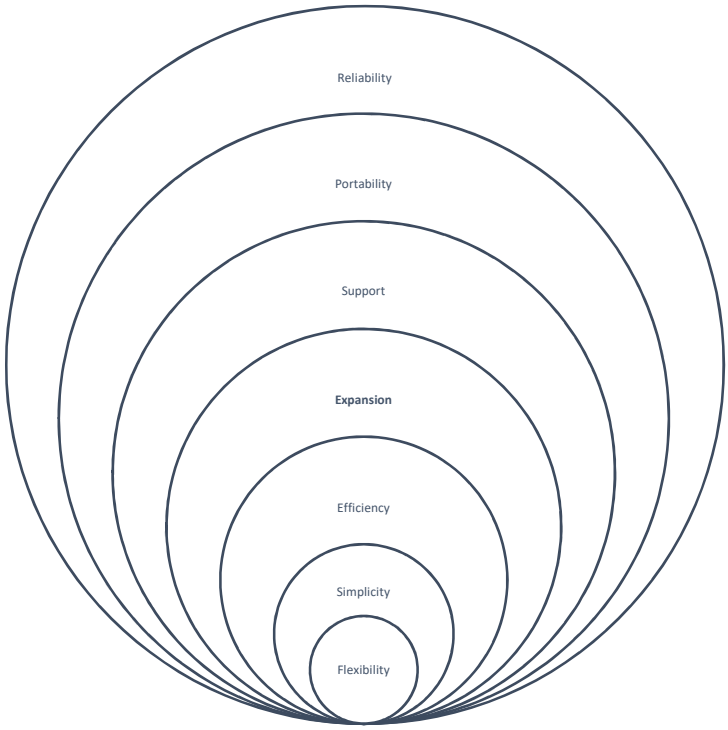
Furthermore, the paper investigates modern approaches to data management, focusing on technologies like Big Data analytics, machine learning, and artificial intelligence. These approaches empower logistics stakeholders to extract valuable insights from massive datasets, optimize routing and scheduling, predict demand patterns, and enhance overall supply chain visibility. The integration of real-time data streams and the utilization of cloud-based platforms are explored as key enablers for agile and responsive logistics operations [2-3].

The study also highlights the challenges associated with the implementation of these advanced technologies, such as data security and privacy concerns, interoperability issues, and the need for skilled professionals. By addressing these challenges, logistics enterprises can harness the full potential of digital knowledge formalization and modern data management to drive innovation and gain a competitive edge in the dynamic logistics industry.

This paper provides a comprehensive overview of the formalization of digital knowledge and modern data management approaches in the logistics sector. It serves as a valuable resource for logistics professionals, researchers, and policymakers seeking to navigate the complexities of the digital era and optimize their operations through informed decision-making and data-driven strategies [4-5].

Choosing a Knowledge Management System

Choosing a programming language for a knowledge management system involves considering additional components, such as:



- **Flexibility**-Refers to the high likelihood that the system can be used for various tasks and purposes, as it incorporates numerous instruments and elements.
- **Simplicity**-Learning to use the program should not require additional resources. The simplicity of its rules and tools increases the likelihood of its ease of use
- **Efficiency**-The efficiency of tools is primarily related to the speed of execution, which is closely linked to the reduction in the number of operations required by program to solve the problem. The above mentioned fact improves the program's efficiency .
- **Expansion**-represents the ability of the system to integrate and improve. System integration can be achieved through various means. For example, increasing the size of the database in the knowledge base for the purpose of adding data, which will be accessible to external programs.
- **Support**-refers to customer support in the context of the sale of programming languages. In cases of need, it includes communication with customers, encompassing telephone calls, training sessions, and consultations.
- **Portability**-This term refers to the duration of product functionality and the technicality of its delivery. For example, if a product is designed for a specific type of machinery production, it will never be a portable system.
- **Reliability**-The reliability of software is determined by the duration during which developers have used and tested it. The longer the period, the higher the level of reliability.

Classification of Knowledge Management System Tools:

Programing Language

Java is used as a programing language in the Knowledge Management System, which gives ability to develop system's capability for effective knowledge management. Programming languages have advantages and disadvantages.

Its advantage is the wide use of this language. Moreover, it is easy to understand, while Its limitation lies in the facilitator's inability to incorporate additional functions, such as rules, preferred forms, rule modifications, and similar features.

To create uncomplicated knowledge-based systems suitable for use as programming languages, it is essential to incorporate functions like IF, THEN, and others [6-7-8].

IF-THEN rules encompass autonomous rules for knowledge components, modal and minor comparisons. This allows for the removal of outdated rules and the addition of new ones. Various types of knowledge representation logics are utilized, including :

1. Propositional Logic (PL): Represents knowledge using simple propositions and logical connectives.
2. First-Order Logic (FOL): Allows the representation of complex relationships using variables, quantifiers, and predicates.
3. Higher-Order Logic (HOL): Extends first-order logic by allowing quantification over functions and predicates.
4. Modal Logic: Incorporates modalities such as necessity and possibility to express knowledge about necessity and contingency.
5. Fuzzy Logic: Handles uncertainty and imprecision by allowing degrees of truth between 0 and 1.
6. Multivalued Logic: Represents knowledge with more than two truth values, accommodating situations where truth is not simply binary.
7. Temporal Logic: Deals with the representation of time-dependent knowledge and events.
8. Description Logics (DL): Focuses on representing structured knowledge with a focus on taxonomy and classification.
9. Frame-Based Representation: Uses frames or semantic networks to represent knowledge with structured frames containing attributes and values.
10. Rule-Based Systems: Represent knowledge through a set of IF-THEN rules that define relationships and actions.

The stated rules enable the implementation of a decision support system within the organization, enhancing the speed and effectiveness of managerial processes.

CONCLUSION

To summarize formalization of acquired knowledge plays a crucial role in enhancing organizational management efficiency. Effectively addressing specific tasks often requires tapping into the comprehensive knowledge possessed by experienced employees. Therefore, it is important to integrate a decision support system that encompasses all types and stages of management. Regardless of the type of organization, the system of using tools simplifies the formalization and representation of its knowledge, which forms the basis for fast and efficient management.

References:

1) Tamar Bitchikashvili, Liliy Petriashvili, and Luka Kavtelishvili Jang. 2023. "DIGITALIZATION OF MANAGEMENT OF A HIGHER EDUCATIONAL INSTITUTION, NATIONAL AND INTERNATIONAL CHALLENGES AND WAYS OF SOLUTION". World Science, no. 3(81) (September). https://doi.org/10.31435/rsglobal_ws/30092023/8032
2) Doborjginidze G., Petriashvili L. (2020) "Improving Efficiency of Inventory Identification System" European Science Review, Issue 1-2. DOI: https://doi.org/10.29013/ESR-20-1.2-84-88 Pages: 84 – 88
3) Giorgi Doborjginidze, Lily Petriashvili, Mariam Inaishvili (2021) Optimization of Inventory Management in the Supply Chain. Journal of Communication and Computer, David Publishing Company 16 (2021) 1-5 DOI: https://doi.org/10.17265/1548-7709/2021.01.001
4) Giorgi Doborjginidze, Lily Petriashvili, & Mariam Inaishvili. (2020). IMPROVE EFFICIENCY AND RELIABILITY OF SUPPLY CHAINS USING SMART CONTRACTS. International Academy Journal Web of Scholar, (8(50), 1-6. https://doi.org/10.31435/rsglobal_wos/30122020/7261
5) Nona Otkhozoria, Lily Petriashvili, Ani Kudukhashvili, and Nino Kakhurashvili. 2023. "COMPARATIVE ANALYSIS OF COMPLEX INFORMATION SYSTEM TESTING METHODS". World Science, no. 4(82) (November). https://doi.org/10.31435/rsglobal_ws/30122023/8076
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ციფრული ცოდნის ფორმალიზაცია და მონაცემთა მენეჯმენტის თანამედროვე მიდგომები

ქეთევან არევაძე

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აბსტრაქტი

მართვის თანამედროვე მიდგომები ეფუძება ორგანიზაციაში დაგროვილი ცოდნის ფორმალიზებას და შემდგომში გადაწყვეტილების მხარდამჭერი სისტემების დანერგვას. ორგანიზაციებში დაგროვილი ცოდნის ფორმალიზებისთვის საჭიროა განვიხილოთ მონაცემთა ფორმალიზების ფორმები. ცოდნის კარგი ბაზების განსავითარებლად საჭიროა კარგი ცოდნის რეპრეზენტატორი. განვიხილოთ ცოდნის რეპრეზენტირების ასპექტები სემანტიკური ვების მაგალითზე. არსებობს მონაცემთა შენახვის ზოგიერთი გავრცელებული ხედვა. დოკუმენტთა სისტემა, საგანზე ორიენტირებული მონაცემთა ბაზა, რელაციური მონაცემთა ბაზა, ობიექტ რელაციური მონაცემთა ბაზა.

ცოდნის მართვის სისტემის პროგრამული ენის შერჩევის დროს გასათვალისწინებელია დამატებითი კომპონენტები, როგორიცაა: მოქნილობა, პროგრამის გამოყენების შესწავლის სიმარტივე, ეფექტურობა, გაფართოვება, მხარდაჭერა, პორტაბელურობა და საიმედოობა.

ცოდნის მართვის სისტემის ინსტრუმენტების კლასიფიკაციას წარმოდგენს: წინადადების ლოგიკა (PL), პირველი რიგის ლოგიკა (FOL), უმაღლესი რიგის ლოგიკა (HOL), მოდალური ლოგიკა, ბუნდოვანი ლოგიკა, მრავალმნიშვნელოვანი ლოგიკა, დროითი ლოგიკა, აღწერითი ლოგიკა (DL), ჩარჩო და წესებზე დაფუძნებული სისტემები.

ორგანიზაციის ტიპის მიუხედავად, მრავალფეროვანი ინსტრუმენტების მქონე სისტემა ამარტივებს მისი ცოდნის ფორმალიზებას და რეპრეზენტირებას. რაც საფუძვლეს ქმნის სწრაფი და ეფექტური მართვისთვის.

საკვანძო სიტყვები: ციფრული ცოდნა, ცოდნის ფორმალიზება, ციფრული მართვა, ცოდნის მართვის სისტემა