Exploring the Applications and Implications of DIKW Hierarchy in the LIS Domain: A Comprehensive Study

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Abstract

Purpose: *The objective of the study is to explore the applications and implications of the Data Information Knowledge and Wisdom (DIKW) Hierarchy in the domain of Library and Information Science (LIS). The study aims to examine how the DIKW Hierarchy can be used as a framework for understanding the transformation of information into knowledge and its practical application within library environments.*

Design/methodology/approach: *This study employed a systematic literature review methodology, which involved conducting a comprehensive analysis of relevant research articles, books, and scholarly sources to gather information and insights on the topic.*

Findings: *This study found that the DIKW Hierarchy is widely recognised and used in library and information science. It highlights the significant role of this framework in understanding how data is transformed into knowledge and wisdom in libraries.*

Research Limitations: *The scope of this study is limited to exploring the applications and implications of the DIKW Hierarchy specifically within the domain of LIS, neglecting other domains or industries where the hierarchy could be relevant.*

Practical Implication: *The study provides practical guidance and insights for professionals in effectively organising and managing information resources, improving knowledge creation and dissemination processes, and enhancing decision-making capabilities within LIS environments. The findings of this study can help practitioners in LIS optimise their information systems, improve information retrieval and analysis methods, and ultimately contribute to more efficient and informed decision-making in the field.*

Originality/value: *The study offers valuable insights and an understanding of how the DIKW Hierarchy can be effectively utilised in managing information resources, promoting knowledge creation, and enhancing decision-making processes within LIS environments.*

Keywords: *Data Information Knowledge and Wisdom Hierarchy, DIKW Hierarchy, DIKW Pyramid, Information Hierarchy, Knowledge Management, Library and Information Science (LIS).*

Article Type: *Descriptive.*

1. Introduction: The Data Information Knowledge and Wisdom Hierarchy, often known as the DIKW Pyramid, is becoming increasingly popular in a variety of domains. In the information science domain, the hierarchy is often referred to as the "information hierarchy" or "information pyramid,", while in the knowledge management domain, it is referred to as the "knowledge hierarchy" or "knowledge pyramid." The choice of "information" or "knowledge" in the terminology is typically influenced by the perceived manageability within specific professions (Sharma, 2008).

In the domain of library and information science (LIS), the DIKW hierarchy serves as a useful framework for understanding the transformation of information into knowledge and its practical application in library environments. Libraries play a significant role in gathering, organising, and disseminating information to address the varied demands of their users. The DIKW Pyramid offers a structured approach to managing information resources and promoting knowledge creation and sharing within library environments. This article presents

a comprehensive study that explores the applications and implications of the DIKW Hierarchy in the LIS domain.

2. Literature Review: Literature Review: In Bernstein's (2011) article titled 'The Data-Information-Knowledge-Wisdom Hierarchy and its Antithesis,' he explores the hierarchy of data, information, knowledge, and wisdom, along with their opposite counterparts. The author discusses the interconnected nature of these concepts and how they form stages in a developmental process. The paper examines the relationships between phenomena such as misinformation, errors, ignorance, and stupidity and their connections to knowledge organisation systems. Bernstein introduces the term 'non-knowledge' to encompass the entire spectrum of the opposite of knowledge, including the absence of data, ignorance, and various forms of error. Additionally, the article highlights the growing interest in studying subjects like stupidity and ignorance and their implications for understanding knowledge.

The article authored by Bellinger, Castro, and Mills (2004) explores the distinctions and relationships between data, information, knowledge, and wisdom. It begins by presenting Russell Ackoff's categorization of the human mind's content, emphasising that wisdom is the only category that deals with the future. The article then provides further elaboration on each concept. Data is described as raw and lacking inherent meaning, while information is processed data with relational connections. Knowledge is seen as the collection of useful information, while understanding involves the synthesis of knowledge to gain deeper insights. Wisdom, considered a uniquely human state, encompasses understanding, judgement, and moral considerations. The article concludes by highlighting the importance of understanding in transitioning between each stage and noting the subjective nature of perceiving patterns and deriving meaning from them.

Russell Ackoff (1988) is often recognised as the initiator of the DIKW hierarchy in knowledge management. His Presidential Address to the International Society for General Systems Research (ISGSR) is considered an influential piece in the development of the DIKW Pyramid. In this address, Ackoff emphasises the importance of progressing from data to wisdom in the educational process. He highlights that while schools primarily focus on transmitting information, less attention is given to knowledge and understanding. Ackoff defines data as symbols representing the properties of objects and events, while information is processed data that increases its usefulness. Knowledge is conveyed through instructions, and understanding is conveyed through explanations. While information, knowledge, and understanding contribute to efficiency, wisdom is necessary to enhance effectiveness by considering values and exercising judgement. Ackoff suggests that wisdom cannot be generated by computerised systems and emphasises the need for education to allocate time for its development. Unfortunately, he notes that schooling often neglects not only the cultivation of wisdom but even the collection of data and generation of information.

Rowley (2007) gives a thorough analysis of the library science literature that discusses DIKW and lists the various definitions given for each element. She concludes by pointing out the major ambiguity in the connections between the components and the fact that "wisdom is a neglected concept in the knowledge management and information science domain". In her article titled "Representations of the Wisdom Hierarchy", she examines the concepts of the DIKW hierarchy (data, information, knowledge, wisdom) in information systems and knowledge management. The article finds that while the hierarchy is implicitly present in the definitions, there is a lack of consensus on its structure and the definitions of its elements. The paper emphasises the need to differentiate between meaning and structure in distinguishing data from information and raises questions about the overlap between definitions of information and knowledge. Furthermore, the article highlights the neglect of the concept of wisdom in the literature and calls for more research and discussion on the nature of wisdom at individual and organisational levels. Overall, the article aims to stimulate

debate and further exploration of the wisdom hierarchy and its implications in the field of information management.

3. Understanding DIKW Hierarchy: Understanding DIKW Hierarchy: The Data Information Knowledge and Wisdom Hierarchy, also known as the DIKW Pyramid, is a conceptual framework that illustrates the relationships and progression of data into wisdom. It symbolises a hierarchical structure where each level builds on the one before it, converting unprocessed data into insightful information and informed decision-making. The DIKW Pyramid is widely used in various domains, including knowledge management and information science, to understand and manage the process of converting data into actionable knowledge.

According to Wikipedia (2023), "The DIKW pyramid, also known variously as the DIKW hierarchy, wisdom hierarchy, knowledge hierarchy, information hierarchy, information pyramid, and the data pyramid, refers loosely to a class of models for representing purported structural and/or functional relationships between data, information, knowledge, and wisdom."

The DIKW Pyramid represents the "relationships between data, information, knowledge, and wisdom. Each building block is a step towards a higher level: first come data, then information, then knowledge, and finally wisdom. Each step answers different questions about the initial data and adds value to it. The more we enrich our data with meaning and context, the more knowledge and insights we get out of it, so we can take better, informed, and data-based decisions" (DIKW Pyramid, 2022).

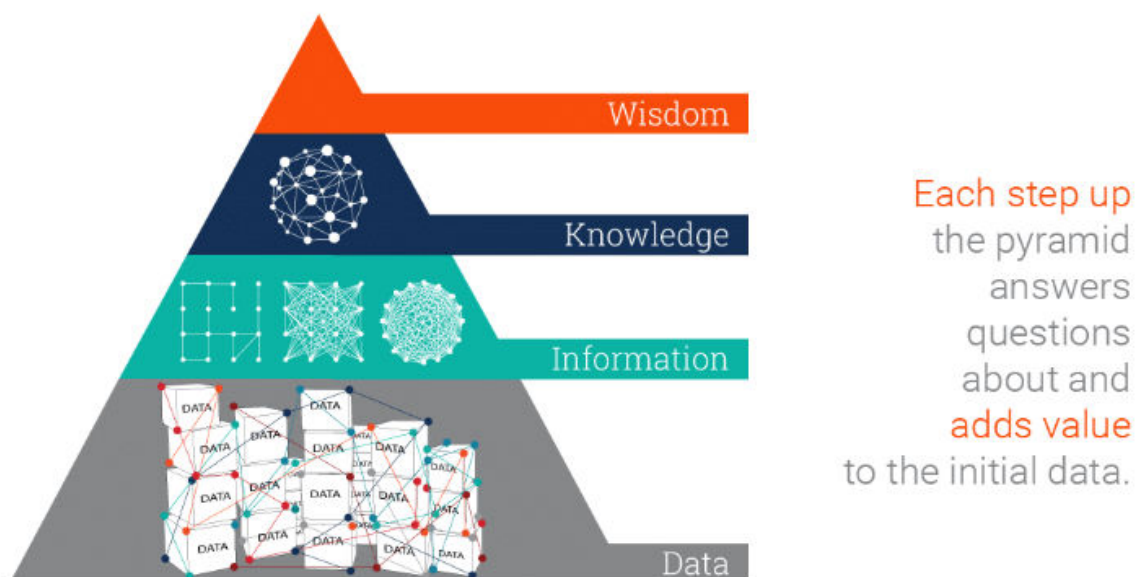For a clearer understanding, please refer to the figure below.

Fig. 1: DIKW Hierarchy
(Source: https://www.ontotext.com/knowledgehub/fundamentals/dikw-pyramid/)

a) The "Data" of the DIKW Hierarchy: At the base of the DIKW Hierarchy lies "Data". Data refers to raw, unprocessed facts, figures, and observations that have yet to be organised or given meaning. It represents the building blocks of information and knowledge.
b) The "Information" the of DIKW Hierarchy: Moving up the hierarchy, we reach the level of "information.". Information is derived from data through processes such as collection, organisation, classification, and analysis. It provides context and structure to the

raw data, making it meaningful and usable. Information answers the "what", "when", "where", and "who" questions.

c) The "Knowledge" of the DIKW Hierarchy: The next level is "knowledge". Knowledge involves the understanding and interpretation of information. It goes beyond the mere collection and organisation of data to include insights, connections, and patterns. Knowledge answers the "how" and "why" questions, allowing individuals to apply information in a meaningful way.

d) The "Wisdom" of the DIKW Hierarchy: At the top of the hierarchy is "wisdom.". Wisdom represents the highest level of understanding and the ability to apply knowledge in a meaningful and insightful manner. It involves critical thinking, judgement, and the ability to make sound decisions based on experience, intuition, and ethical considerations.

The DIKW Pyramid provides a framework for organisations and professionals to manage and utilise information effectively. It emphasises the path from data to wisdom and stresses the significance of turning raw data into informative knowledge. Professionals in a variety of fields, including knowledge management and information science, can improve their decision-making processes, information sharing, and collaboration, and ultimately achieve greater insights and outcomes by comprehending and applying the principles of the DIKW Hierarchy.

4. Tracing the Origins: In the field of knowledge management, Russell Ackoff is commonly credited with the invention of the DIKW Hierarchy. In 1988, he delivered his Presidential Address to the ISGSR, which is considered one of the earliest mentions of the hierarchy. The address, which appeared in 1989 as the paper "From Data to Wisdom", describes the DIKW hierarchy. Interestingly, Ackoff's article does not reference any earlier sources for the hierarchy, leaving its origins somewhat uncertain (Ackoff, 1988).

However, prior to Ackoff's address, Milan Zeleny emerged as an earlier proponent of the hierarchy in the knowledge management domain. Zeleny provides a thorough explanation of the DIKW hierarchy in his 1987 article on "Management Support Systems". He (Zeleny, 1987) equates data, information, knowledge, and wisdom with "know-nothing", "know-what", "know-how,", and "know-why," respectively, assigning various knowledge forms to each level of the hierarchy. Zeleny first mentioned the hierarchy in 1987, before Ackoff delivered an address, indicating the importance of his contribution to the DIKW hierarchy's introduction to the field of knowledge management.

In the domain of information science, the DIKW hierarchy emerges as early as 1982, when Harlan Cleveland writes about it in a futurist article. Cleveland (1982) provides a detailed description of the information-knowledge-wisdom hierarchy, including an illustrative example.

It is interesting to note that the earliest mention of the DIKW hierarchy came from poetry, not from the domains of information science or knowledge management. Harlan Cleveland attributes the idea of hierarchy to T.S. Eliot in a futurist article. Even Cleveland goes so far as to call it "The T.S. Eliot Hierarchy". Unexpectedly, T.S. Eliot, a well-known poet, offered the idea of the DIKW hierarchy without specifically calling it that. Eliot penned the following lines in "The Rock," a poem he published in 1934:

"Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?" (Eliot, 1934, p. xx)

5. Applications of the DIKW Hierarchy in LIS: In the LIS domain, the DIKW hierarchy finds practical applications that enhance the efficiency and effectiveness of information services. Let's explore some real-life applications of the DIKW hierarchy in the LIS domain:

a) Collection Management: Libraries organise and curate their collections using the DIKW hierarchy. Through cataloguing, classifying, and indexing, data that is present in the form of

raw materials like journals, books, and multimedia resources is transformed into information. This organised information enables LIS professionals and users to extract knowledge by discovering relevant resources and understanding their content. When librarians apply their in-depth knowledge of user requirements and trends to guide their decisions on collection development, acquisition, and resource allocation, they are demonstrating wisdom.

b) Information Retrieval: The development of efficient information retrieval systems is aided by the DIKW hierarchy. Data, in the form of user queries or search words, is transformed into information by matching them with indexed records and producing search results. Users gain knowledge when they assess the information they acquire in order to satisfy their individual information demands. When librarians use their knowledge to assist users in enhancing their search strategies and selecting the most pertinent and trustworthy sources, they are demonstrating wisdom (Checkland and Holwell, 1998).

c) Knowledge Organisation: In libraries, knowledge is organised using the DIKW hierarchy. Through indexing and classification systems, data represented as metadata and controlled vocabularies is converted into structured information. When librarians use their subject-matter expertise to develop significant relationships and contextualise content inside the collection, knowledge is created. When librarians use their own judgement to create ontologies, taxonomies, or other knowledge organisation systems that help users find resources efficiently, they are demonstrating wisdom (Zeleny, 1987).

d) Information Literacy: Libraries information literacy programmes depend extensively on the DIKW hierarchy. Through critical analysis and interpretation, data such as those found in books, articles, or online databases becomes information. By analysing and synthesising the data, users gain knowledge while developing their information-seeking, information-evaluation, and ethical-use abilities. When individuals use their newly gained information and abilities to solve issues, make wise decisions, and advance their personal and professional development, they are said to have attained wisdom.

e) Research Support: Libraries provide research support services to their patrons by using the DIKW hierarchy. Data, in the form of research data sets, literature reviews, or bibliographic databases, is processed into information through data curation, analysis, and synthesis. By analysing and interpreting the data, identifying patterns, and developing insights, researchers gain knowledge. When academics use their knowledge to create original contributions, publish scholarly contributions, publish scholarly publications, and advance their fields of study, they are demonstrating wisdom.

By applying the DIKW hierarchy in the LIS domain, libraries are able to effectively manage their collections, facilitate information retrieval, organise knowledge, promote information literacy, and support research endeavours. This structured approach enables libraries to provide valuable and relevant information services to their users, empowering them in their quest for knowledge and information.

6. Implications of the DIKW Hierarchy in the LIS Domain: The DIKW Hierarchy has diverse and important effects on the field of library and information science (LIS). LIS professionals and institutions can benefit from a number of significant implications by adopting and utilising the DIKW Hierarchy:

a) Enhanced Information Organisation: The DIKW Hierarchy provides a structured framework for organising and categorising information within libraries. By understanding the hierarchical relationship between data, information, knowledge, and wisdom, librarians can develop more effective systems for cataloguing and classifying information, making it easier for users to access and retrieve relevant resources.

b) Information Retrieval and User Experience: Applying the DIKW Hierarchy enables libraries to enhance their information retrieval systems and improve the user experience. By incorporating metadata, indexing, and tagging techniques that align with the hierarchical

structure, libraries can offer more accurate and contextually relevant search results, leading to increased user satisfaction and efficient information discovery.

c) Knowledge Creation and Sharing: The DIKW Hierarchy emphasises the transformation of data into knowledge and wisdom. In the LIS domain, this implies that libraries can actively facilitate knowledge creation through various means such as research support services, collaboration spaces, and information literacy programmes. Libraries become not just repositories of information but also dynamic environments that promote the generation and dissemination of knowledge.

7. Challenges and Limitations: Despite the fact that the DIKW hierarchy has proven to be a useful framework in the field of library and information science (LIS), there are still a number of issues and restrictions that must be resolved before it can be used in an effective manner. Understanding and overcoming these challenges is essential if the hierarchy in LIS environments is to be used to its full potential.

One of the main challenges is the subjective nature of knowledge and wisdom. Individual viewpoints, experiences, and biases have an impact on the process of transforming data into information and knowledge. The same information may be interpreted and meaning extracted by different users in different ways, resulting in variances in knowledge development and understanding. Overcoming this challenge requires a comprehensive approach that acknowledges the diverse ways in which individuals perceive and construct knowledge.

The rapid development of technology and the increasing volume of information available present additional challenges. Libraries now have the difficult task of maintaining and organising massive amounts of data and information due to the growth of digital resources. This requires effective information retrieval systems, reliable data management practises, and knowledgeable information specialists who can navigate and understand complicated information landscapes.

8. Criticisms: While the DIKW hierarchy has been widely accepted and used in various fields, it is not without its critics. Here are some criticisms of the DIKW hierarchy from different authors:

Zins argues that the DIKW hierarchy oversimplifies the process of knowledge creation and overlooks the importance of social and cultural factors in knowledge development. According to Zins, knowledge creation is a complex and social process that involves integrations, negotiations, and interpretations among individuals and communities (Zins, 2007).

Rowley argues that the DIKW hierarchy fails to account for the role of human interpretation and subjective judgement in the transformation of data into knowledge. According to Rowley, knowledge is not solely derived from data, but is also influenced by personal and social factors, such as beliefs, values, and experiences (Rowley, 2007).

Davies and Kidd criticise the DIKW hierarchy for its linear and one-way progression, suggesting that it does not capture the dynamic and iterative nature of knowledge creation (Davies & Kidd, 2008).

Bawden and Robinson criticise the DIKW hierarchy for its focus on information as an intermediary between data and knowledge. They argue that information is not simply a neutral and objective entity but is imbued with meaning and interpretation. They propose an alternative model that emphasises the active role of individuals in creating and interpreting information (Bawden & Robinson, 2009).

Checkland and Holwell criticise the DIKW hierarchy by arguing that it oversimplifies the complex nature of knowledge and fails to capture the role of human interpretation and sense-making in knowledge creation. They propose an alternative framework called the

"system approach", which emphasises the contextual and subjective nature of knowledge (Checkland & Holwell, 1998).

These authors highlight various concerns with the DIKW hierarchy, including its oversimplification of knowledge creation, linearity, reductionism, and ambiguity in definitions. They propose alternative frameworks or emphasise the need to consider the subjective, contextual, and experiential aspects of knowledge.

9. Conclusion: Conclusively, the DIKW Hierarchy provides a valuable framework for understanding the conversion of data into wisdom within the context of LIS. This comprehensive study has examined the applications and implications of the DIKW Pyramid in LIS, highlighting its significance in information organisation, knowledge management, decision-making, and information services. By embracing the principles of the DIKW Hierarchy, libraries can effectively harness their information resources, promote knowledge creation, and better serve their users in an increasingly complex information landscape.

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