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Optimizing Information Management for Decision Support: Insights from Big Data Analytics

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Abstract: Background: With the explosion of data in our time, organisational information management and decisions have undergone a complete transformation. Larger scale Data Analysis may help detect numerous hidden Relationships in vast volumes Unstructured Information; yet this field also fails to produce concrete business guidance for all companies. Objective: To examine whether big-data analysis optimizes organisational Information Management Practice to improve the Quality of Decision Support under Organisational Context. Method: Based on publicly available data from international organizations such as IDCs global data sphere, the World Economic Forums Global Competitiveness Report, and relevant empirical research to synthesise evidence about the trend of BDA application, information management problems, and the results of decision-making support. A theoretical Framework combining the DIKW hierarchy, Decision-support System (DSS), Theory and the Resource-based view (RBV) is proposed and tested. Results: Global Data Creation will be approximately 175 ZB by 2025. Organizations with mature BDA capabilities demonstrate 5-6% higher productivity and 4-6% higher profitability than competitors. Optimisation Strategies for Key Points: Real-time Data Integration; Predictive Analytics Deployment; Governance Framework Building. To sum up, a good use of big data analysis to manage needs more effective decision-making support; However, all these changes are also related to strengthening the companys governance capabil ity and achieving strategic alignment well.

Keywords: Big data analysis; Information Management; Decision Support Systems; Organisational Decision-Making; Data Governance.

1. Introduction

Globalisation has resulted in a massive amount of rapid-moving vast quantities of different types of Data. According to the IDC Global DataSphere report, globally produced, acquired, reproduced, or consumed large amounts of data in 2020 amounted to 64.2 zettabytes; It is expected that this figure will increase to as high as 175 zettabytes by 2025. There are both many great possibilities and difficulties among a large quantity of organisational data. Traditional information management systems cannot manage unstructured high-volume data environments well; they are also unable to process heterogeneous, constantly updating large volumes of digitalised (Data) Streams efficiently.

Organisations own competitive decision support systems have been seen as indispensable for some time now. The early DSS systems were mainly system-based and model-oriented, and they emerged from the 1970s to the 1980s [4]. The advent of big data analysis has significantly expanded the range and ability of decision-making support systems; it is now possible to obtain useful information even from a large amount of unsupervised documents, social networks, sensors, transactions, etc. According to the McKinsey Global Institute, data-driven organisations have acquired customers at a rate of 23 times higher than non-data-driven ones; were six times as likely to retain customers as others; And they had nineteen times greater profit level.

Although some applications of BDA have appeared in deciding between different enterprises; still, it encounters difficulties when being applied practically. As shown by the 2022 "NewVantage Partners" report, only 26.5 per cent of the enterprises have established Data-Driven organizations; Almost all (97.6%) admitted that they were still actively investing in large-scale Big-data and AI projects. The absence at this point suggests that a comprehensive System for Connecting Analysis Capability with Decision Results is necessary. Based on addressing the aforementioned deficiencies, this study has established an integrated framework of optimising Information Management based on big Data analysis.

Specifically, the purpose is as follows: First, Identify the main problems existing in current information management practice affecting efficient decision-making support; Second, Synthesis public data and research results related to optimising BDA strategy; Third, Formulate a conceptual model based on the analysis link between BDA capability and decision-making support level; Fourthly, Summarize some application effects of organisations to build their own big-data platform to provide organizational reference.

2. Literature review

2.1. Management Information and decision-making support systems.

Management of information is: The collection, organization and storage of it, protection, search for, broadcast etc., aiming at achieving the goal of organisations management. Research into the Development of the theory for Information management reveals that information holds an essential role in Companies Strategies. Early frameworks focused on improving Data-processing Efficiency, while recent directions are aimed at Knowledge-Creation and Competitive-Intelligence. In 1971, Gorry and Morton put forward the idea of developing a decision support system by computer to help people solve problems with certain semi-formal structure under some uncertainty interactively inputting data and building models. The DSS literature has evolved through three generations: model-driven DSS (1970s-1980s), data-driven DSS (1990s-2000s), and knowledge-driven DSS incorporating machine learning and

artificial intelligence (2010s-present) [4].

According to the World Economic Forum, ICT application rate and innovation ability are frequently highlighted in global competitive index rankings; [8] Generally, Countries that have established a strong foundation for digital infrastructures and rich resources in big data processing tend to be More efficient in information management optimisations.

2.2. Big data analysis: concepts and frameworks.

The concept of big data was originally characterized by three dimensions: volume, velocity, and variety [11]. Building on this foundation, the 5Vs of big data typically refer to a large amount of information, high speed of generation and transmission, multiple forms of data, low truthfulness in the original data, and significant economic value [2]. Through rich detailed Data, many ways of discovering intricate correlations between several closely related Factors with machine learning, natural language processing, Graph analysis, Real time monitoring Technologies are available. Gandomi and Haider [2] have established a complete classification System of BDA method, consisting of three parts: description part (What happened) Diagnose Part (why it happened)) Prediction Part What will happen prescriptive Analyis what to do.

According to IDC forecasts, the world will spend close to $274.3 billion on scale updata Centers and Business Intelligence Construction between 2022 and 2026 at an annual Compound Growth Rate (CAGR) over 13.2%. The investment behaviour shows generally organisational acceptance of BDA as a source of competitiveness; But return varies because the effect varies according to how well implemented or which kind matches strategically.

2.3. Integration of big data in organisational decision-making.

Integration of BDA in organisational Decision-Making-Process should be achieved through the interconnection of technology-Organisational-Human Three-Dimensions.Provost and Fawcett [9] further argued that data science and big data are fundamentally linked to data-driven decision making, emphasising that the value of BDA lies not in data collection itself but in its application to improve organisational decisions Davenport and Harris [5] define the three stages of analytical competition as follows: Analytical Aspirations (Organisations start to use Data); Analytical Companies (Organizations have Enterprise-level analysis ability); And Analytical Competitors (Using Analytics as their competitive advantage) are identified. Fortune 500 companies, in the study by their team on analytical competitors, showed a 5-6% increase in output compared to industry leaders [5].

Based on Chens synthesis of the business intelligentis ation and analysis literatures, it has been identified that for an efficient business decision-support system (BDS), necessary elements should include its data-management-infrastructure basis; Analytical-model foundation; Users -interface component. It is also necessary, in addition, that after introducing these new technologies into BDA; some problems must still be resolved first for its application.

2.4. Research Limitations

Although both have achieved some progress so far, they still lack a bit of fundamental issue. Most of the existing research focus on BDA penetration in large companies within developed countries and have few data for small- to medium-sized enterprises (SMEs) or underdeveloped regions. Secondly, there are no specific mechanisms for how BDA abilities enhance decision quality compared with decision speed or cost reduction; Thirdly, there have been insufficient studies addressing how Information Governance Frameworks mediate the Mediation of BDA-Decisor support Relationships. Through an integrated theory framework and publically available evidence, this paper aims to close the above-mentioned deficiencies.

3. Theoretical framework

3.1. Data-information-knowledge-wisdom (DIKW) hierarchy.

The DIKW hierarchy serves as an outline to guide the transition from raw materials to useful knowledge [3]. Data: Raw facts without organisation or context; Information: Organised, contextualised data; Knowledge: Synthesised knowledge built on top of experience and judgment; Wisdom: Applications of knowledge for practical purposes achieved by humans. The application of big data analysis can accelerate and expand throughout all DIKW domains the process by which organisations transform huge volumes of unprocessed data into useful knowledge quickly in a scale beyond human comprehension. The DIKW model helps us conceptualise an optimised information management system that aims to improve the efficiency and effectiveness of transforming data into wisdom.

3.2. Decision support system (DSS) theory.

Based on Gorry and Scott-Morton (1971)s pioneering work, DSS theory posits that Decision Support System is defined as an Information-Model-Analytic Tool system that helps people make their decisions more reasonable when dealing with Semi-Bounded-Unbounded Situation. Based on modern DSS Theory, Algorithms are applied in the study to examine whether they can provide Decision Support beyond ordinary peoples understanding. Incorporating BDA within the DSS structure to establish a dynamic, evidence-driven Decision Support System for Organisations and separate them from traditional systems reliant solely upon batch processing and static model foundations.

3.3. Resource-based view of information assets.

Based on the resource-based view of firms, which suggests that long-term competitive advantages can be achieved through valuable, scarce, hard-to-imitate and difficult to substitute resources [5]. The RBV framework suggests that, in terms of organisational Data assets and Analytical Capabilities as Strategic Resources under conditions meeting VRIN. Unique proprietary datasets, analysis models, embedded data culture all constitute incommunicable information resources for other companies to imitate easily. Therefore, from a certain perspective, BDA-driven information management optimisation is not just an engineering issue but also the construction of organisational ability to ensure Organizational Performance and positioning on the market.

4. Methodology

4.1. Design research.

Based on the combined use of systematic literature review,

secondary data analysis, and concept building in this study. Following the PRISMA guidelines, this systematisation of literature included all peer-reviewed papers published from 2000 to 2023 on information Systems, Management and Computer Science journals. Secondarily, using the publicly available datasets of IDC, WEF, Gartner, and McKinsey Global Institute to quantitatively assess BDA application trend profiles and associated outcome indicators.

4.2. Data sources and collection.

Primary quantitive data come from: (1) IDC Global DataSphere reports (2018 - 2022), the trend of global data volume and BDA investment; (2) WEF Global Competitiveness Reports (2019-2022) on national digital competitiveness indices [8]; (3) NewVantage Partners big-data-and-ai executive survey in 2022, which contains organisational BDA adoption and maturity data [7]; And (4) The analytical report published by McKinsey Global Institute for Productivity and Profit Impact Estimate. These references provide international recognition and verified methods for measuring the implementation status of BDA organisations or countries impact.

4.3. Analysis techniques.

Description of the global spread and investment situations for BDAs. Compare the performance gap among organisations of varying degrees of development in BDA maturity. After summarising several documents on a specific topic using a certain method to obtain its pattern or outcome. Based on the iterative synthesis of theoretical perspectives and empirical evidence to develop an integrated conceptual framework, which follows standard procedure for developing theories in information System studies.

5. Results and Analysis

5.1. Current Problems of Information Management.

According to publicly available survey results, problems have existed for a long time in organisational information management. Based on the new Vantage partners 2022 survey, data Isolation remained at an upper limit of obstructing BDAs success for 76.5% of respondents. Data Quality Issues were Ranked Second Highest at 68.3%, Hindering the Level of Decision Support Services. Sixty-four-point-two per cent of enterprises indicated a talent shortage in data science and analysis. According to IDCs data in 2021, although the world-wide investment in big data applications exceeded $21.5bn, and almost three-quarters (around 74%) of accessible corporate data was actually employed by enterprises for analysis purposes; The rest of the 68 per cent falls under "shadow data", which has been collected and analysed, lacking in-depth analysis.

Organizational disintegration of responsibility for Information Management is another issue. According to a 2021 Gartner study, approximately 87 per cent of enterprises in China exhibit sub-optimal Business Intelligence (BI) maturity; In terms of Information Management Functions Distribution, IT Finance Operations Marketing Departments Lack Coordination Mechanisms. Fragmentation cannot promote the implementation of an enterprise-wide data strategy or unify decision-making Support Systems.

5.2. Big Data Analytics Optimization Strategies

Synthesise existing research to identify a total of 4 primary approaches to BDA optimisation in information management. First of all, real-time data integration by establishing a unified data platform can aggregate different types of data from various channels to shorten the time delay in converting data into decision support information. Organizations implementing unified data platforms report 40-60% reductions in data preparation time [6]. Secondly, after setting up the online application for proactive processing of expected incidents after conducting a forward-looking analysis. Finally, the automation of Data quality check via machine-learned abnormal Detection And Data Cleanse Can Reduce labour costs allocated for governing information Accuracies Have Increased. Fourth, self-service analysis platform enables ordinary users to query and visualise data without the help of technical personnel.

5.3. Impact of decision-making support quality.

Several references indicate that the Optimisation of BDAs is relatively advantageous for enhancing the Decision Support Quality. As per Davenport and Harris (2019), the analysing competitor has product output greater than a normal one by about 5-6%; but operational effect is more advanced, close to 4%~6%. According to the McKinsey Global institute, Data-driven decision making can make decisions three or four times faster than intuitive ones and be of better quality; According to WEFs data at the national level, compared with those ranked in the bottom quarter of ICT adoption and data analysis capabilities, country GDP per capita grew by about 1.8 percentage points faster from 2015 to 2022; That is, Information Management optimisation can generate productivity effects on an economy-wide scale not captured within organisational gains.

5.4. Case evidence and empirical findings.

sectoral evidence shows that optimised Information Management based on BDA offers decision-making assistance. Predictive analytics based on electronic health records in hospitals has achieved a drop of up to 10%-20% in hospitalisation rates through prediction; Improve diagnosis by more than 5%. Real-time fraud detection systems based on machine learning can handle up to one million transactions per second and have a false-positive rate as low as 0.1%; thus, they exhibit high-scale application potential for BDA [2]. In supply Chain Management, adding big Data from Social Media, Weather and Economic Indicators can improve demand prediction accuracy by as much as 30%-50%, compared with traditional Statistical Approaches. Some cross-organisational cases show successful implementation of BDA-improved decision support systems in different organisations.A systematic review and longitudinal case study by Wamba et al. [10] confirmed that BDA capability positively influences firm performance across multiple sectors, providing strong empirical support for the decision-support value of optimised information management.

6. Discussion

6.1. Explanation of Major Findings

Multiple public data sources and peer-review articles have provided consistent support for the view that organisations

with good implementations of big-data-analytics integration in their information management system show more effective decision-making compared to those lacking such implementation. Based on the 5%-6% productivity bonus reported by Davenport and Harris (2007) as evidence; economically significant, long-lasting, BDA-driven information Management is also expected to be consistent with R&D-based valuations. Only 26.5 per cent of the organizations have built a data-driven culture after substantial investment in building artificial intelligence technology to support business needs; thus, problems exist in organizational management and governance.

6.2. Comparison of existing studies.

According to Chen et al. (2015) summarisation of the business intelligence literature; Based on our research results, data management infrastructure, analytical models, and users interfaces need to be in place for an effective BDA-DSS integration approach. Emphasising the construction of data governance confirms Gandomi and Haiders (201 5) argument that veracity, which refers to a lack of certainty or doubt about the accuracy of data in practice; Extend existing frameworks to incorporate the DIKW hierarchy specifically for integrating BDA capabilities into decisions and improving quality assessment; Provide more detailed explanations than earlier work by describing the transformations in this way.

6.3. Limitations

Several Limitations Affect This Study Firstly, due to the limitations of using secondary data and published survey results in building a causal relationship between particular BDA practice applications and decision-support outcomes. Secondly, due to publication bias, only those studies that report favourable results for BDA have been identified in the literature review. The rapid development trend of BDA technology causes part of it to become invalid relatively quickly after being verified. Finally, due to restrictions in each field of study, it is impossible to examine in detail at multiple stages and only on one stage.

7. Conclusions and Implications

Use of big data analysis is shown to be a formidable instrument for improving organisa tional management information administration and decision-makers capabilities through this article. Based on IDC, WEF, McKinsey and peer review studies to converge: mature BDA organisations have consistently outperformed the rest in terms of productivity, profit and decision-making accuracy. The research has thus developed an improved DIKW-DSS-RBV architecture, providing reference theories and practices for organisations aiming to improve their competitive edge through the application of big-data technology.

In terms of theoretical basis for contributions, in this research an integrated system combining three independent but interrelated theories is constructed: DIKW; DSS theory; and RBV. Integration indicates that the value of big data analysis is not at high technological level, but in how to bring about change by speeding up and broadening these changes into timely response information for decisions at a faster pace. The organisation needs to improve the following four optimisations: a unified data Platform realisation, deploying preditive analytics and automatically managing Data Quality, promoting self-service Analytics democratisation. Finally, the necessary support is also needed for investing in a data governance system and training analysts, etc. In the future, more longitudinal Design-based organisational-analysis (BDA) approaches will be explored for identifying causal relationships among specific BDA practises and decision-support performance; And extend this studys findings to small- and medium-sized enterprises and other less-researched regions globally.

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