THE ROLE OF VENDORS IN ADDRESSING DATA MANAGEMENT SYSTEMS CHALLENGES TOWARDS IMPROVING DATA-DRIVEN ORGANISATIONAL PROCESSES

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ACADEMIC INTEGRITY DECLARATION

Declaration:

*I, **Neo Naome Gaaje,** declare that this research report is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.*

I further declare that I submitted the thesis/dissertation to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

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ABSTRACT

This study investigates the key role of vendors in overcoming challenges within data management systems to improve data-driven organizational processes. Addressing cybersecurity vulnerabilities, scalability issues, interoperability challenges, and non-standardised data formats, this research delves into how vendors tackle these impediments and optimize data-driven decision-making within organizations. Through a purpose-sampling technique involving ten participants from a population of sixty-five, thematic analysis was employed to obtain insights.

The finding and conclusion of the study show that to ensure scalability, vendors should employ key strategies such as robust infrastructure, robust architecture, and cloud-based solutions with dynamic scalability features to address scalability issues effectively. Furthermore, the technical requirements to achieve interoperability found included adherence to standards, secure data exchange mechanisms, and seamless integration with third-party applications. The study also outlines the overall net benefits attributed to data management systems, emphasizing increased productivity, reduced costs, and improved decision-making processes. Furthermore, the study identifies critical focal points for vendors aiming to enhance data management systems, including adaptability to various data load patterns, data consistency across varied applications, improved integration within cloud environments, and robust data privacy measures. Embracing emerging technologies such as AI, machine learning and block chain, along with continual investment in research and up-skilling, were recommended for sustainable system innovation.

This study provides comprehensive information on how vendors address the challenges in data management systems, offering practical recommendations for managers to enhance scalability, standardize protocols, ensure data security, facilitate interoperability, prioritize adaptability, embrace emerging technologies, and continuously improve systems. Suggestions for future research include longitudinal studies tracking system evolution and cultural impact analysis on data management practices, as well as exploring ethical considerations in data system designs and vendor practices.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMNS

4IR	Fourth industrial revolution
API	Application Programming Interface
CRM	Customer relationship management
DICOM	Digital Imaging and Communications in Medicine
DMS	Data management systems
EHRs	Electronic health records
ERP	Enterprise resource planning
FERPA	Family Educational Rights and Privacy Act
FHIR	Fast Healthcare Interoperability Resources
GDPR	General Data Protection Regulation
HER	Electronic Health Record
HIPAA	Health Insurance Portability and Accountability Act
HL7	Health Level Seven
HST	Health System Technologies
IMS	Information Management System
IS	Information Systems
IT	Information Technology
JSON	JavaScript Object Notation
KPIs	Key performance indicators
LIS	Learning Information Services
LMS	Learning Management Systems
POS	Point-of-sale
RESTful APIs	Representational State Transfer APIs
SIS	Student Information System
SSL/TLS	Secure Sockets Layer/Transport Layer Security
XML	Extensible Markup Language

CHAPTER ONE: INTRODUCTION

1.1 INTRODUCTION

Data management is critical to the success of any organisation. Critical in the sense that it helps organisations identify and leverage the important operational data they possess. Over time, data management has been conceptualised and interpreted differently by multiple scholars. Wang et al. (2002) defined data management as an integrated set of processes and technologies for creating, storing, and analysing data for decision making. Patel, Patel, and Scholar (2016) defined data management as the ability to manage data and information flow. Wang et al. (2002) emphasized the importance of developing and implementing data management systems that integrate with operational and strategic decision-making processes. These processes and systems are necessary to ensure that data are effectively managed and used effectively within an organisation. According to O'Neal (2012), data are a valuable resource that is managed as information through activities of creation, analysis, documentation, transformation, sharing, protection, and preservation. Information can be accessed and controlled using data management systems.

Bolton, McColl-Kennedy, Cheung, Gallan, Orsingher, Witell and Zaki (2018) reports that organizations use data management systems to identify trends in their customer engagement and operational performance. For example, data management may be useful in identifying areas that need improvement and drive efficient business operations; develop accurate forecasts and models to have a competitive advantage. For example, electronic health records (EHRs) play a key role in a complex and rapidly growing digital health, consisting of technology infrastructure and techniques to store, analyse, and disseminate information to enhance quality service delivery. When using health information technology (IT), the information retrieved is only as good as the data acquired at the front end of the system (Blizinsky & Bonham 2018). When organizations implement data management systems, they minimize vulnerabilities and make informed decisions.

Van der Merwe (2021) indicates that data constitutes an essential asset which enables decision-making and strategy. Data strategy is important in making sure that data is considered as an asset. To accomplish this, the data strategy establishes objectives for the effective use of data through methods and practices for managing, manipulating, and sharing data in a repeatable manner (Van der Merwe, 2021). Data management is an

important business practice, as organisations increasingly rely on technology and data-driven decision making. An example in the transport sector is Uber. Uber application (app) collects and analyses data on traffic routes and trip updates, driver behaviour and customer preferences to ensure user satisfaction and ultimately develop new products and services (Siuhi & Mwakalonge 2016). Fu and Soman (2021) asserted that unprocessed data streams act as the foundation of truth for analytics within Uber. The streams are systematically stored in batch processing systems, utilised in a data warehouse, and subsequently accessible for various applications, including machine learning and other data science purposes.

Another sector that relies heavily on data management is finance, which includes banking institutions. Banks collect and keep records of accounts and cash transactions; analyse customer behaviour and preferences, to provide better services, and detect potential fraud and related cyber threats. Cyber-related activities, particularly cybercrime, pose a significant risk to the banking industry. The broad scope of cyberdangers includes everything from natural disasters to threats involving humans (Varga, Brynielsson & Franke, 2021). By analysing data trends, banks can identify suspicious activity and take steps to protect their customers' assets. Therefore, the ability to manage data effectively is argued to be the distinction between failure and success of organisations. Other sectors where data management has enhanced processes and performances are the education, retail, and health sectors.

O'Neal (2012) elaborates that data management includes all disciplines related to data management, including creating and implementing architectures, policies, practices, and procedures for managing the entire data life cycle. Aspects of the data life cycle include planning, digital curation, file naming conventions, policies, and practices for creating metadata, and long-term documentation. Ultimately, the data life cycle puts organizations in a position to become competitive by enabling them to identify trends, opportunities, and solutions faster by filtering data (Chiware & Mathe, 2015). Higher layer technology apps can process unnecessary data and reduce the risks of data source and privacy disclosure (Patel et al., 2016). For example, data filtering techniques such as data anonymization, data integration, and data synchronization are used to hide sensitive details while providing only the essential information required by the applications.

When not adequately planned and implemented, data management is susceptible to risks and threats associated with human errors, cyberattacks, loss of data, identity thefts, and fraudulent activities, which leads to suboptimal performance of an organisation. Therefore, it is imperative to carefully evaluate the planning and implementation process of data management systems to avoid or minimize the imminent failure of organisation's business processes. The background elaborates on challenges associated with data management to articulate the knowledge gap.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

In this section, the challenges associated with data management systems that inhibit optimal operational and strategic decision making by organisations are highlighted and described. These challenges are cybersecurity vulnerabilities, inadequate infrastructure, issues of scalability, lack of systems interoperability, and non-standardised data formats. Consequently, these challenges pose a risk to the success of an organisation and gaining competitive advantage in an increasingly digitised global economy that is characterised as the fourth industrial revolution (4IR) era.

Advancements in technology interconnectivity have increased the vulnerability of data management systems to cyber-attacks (Li & Liu, 2021). Pieterse (2021) concurs that with the growing dependence on IT infrastructure and internet connectivity, South Africa faces an escalating risk of cyber threats. The predominant form of cyber incidents impacting organizations in South Africa over the last ten years has been identified as events leading to data exposure. Without proper security measures in place, an organization could be vulnerable to malicious attacks that could not only lead to the loss of confidential patient information but could also affect the accuracy and reliability of operational and strategic decisions.

According to Sharma et al. (2021), interconnectivity enables quicker communication between technology to allow faster data aggregation and improved machine-to-machine interaction through the Internet. However, increasing internet-worked systems make data management systems susceptible to cyber-attacks that compromise the transmission or stored data leading to misinformation and disinformation. For example, phishing and spoofing are some of the most common cyber-attacks that lead to data breaches, financial losses, as well as reputational harm (Arshad et al., 2021). Although cyber insurance plans

can cover direct financial costs of a breach in some cases, reputational damage can be long-lasting, difficult to quantify, and repair (Lis & Mendel, 2019).

Another prominent challenge in sub-Saharan Africa is infrastructure deficiencies in the sustainability of electricity or power. According to Laher et al. (2019), power outages and a lack of a robust contingency plan are disastrous, with varied and far-reaching effects. Without power, data aggregation, dissemination, analysis, and decision-making processes cannot be performed since they rely on electronic equipment and communication networks. This can lead to data omission and a lack of access to the latest data or real-time data, which causes delays in decision making (Kang et al., 2020). Furthermore, the lack of reliable electricity has severely limited the use of computers and other technology for data management and analysis, making it difficult to access and use important data.

Moreover, backup power sources can be problematic because they are prone to failure if poorly maintained (Malange, 2023). During load shedding or power loss, all data stored on an organization's computers and servers could be lost. This could have major financial, reputational, and operational implications for the organization's customers, partners, and other stakeholders, jeopardizing the organization's success. Pandit and Agrawal (2022) mentioned that lack of efficient Internet connections and uninterrupted power supply causes havoc for online learning in all geographical locations. This is an incredibly challenging problem, especially in developing countries. Without access to reliable internet connections, students are unable to access on-line learning materials, participate in on-line discussions, or attend virtual classes. Converting all offline resources into a comprehensive online library, etc, bears a considerable financial cost, which potentially delays the scalability of data management systems.

Milat, Lee, Conte, Grunseit, Wolfenden, Van Nassau, Orr, Sreeram and Bauman (2020) characterise scalability as the capacity of an intervention, previously validated on a restricted scale or in controlled environments, to be expanded in real-world conditions to encompass a larger segment of the eligible population while sustaining its effectiveness. The expansion of scalability has adverse effects on an organization's utilization of data management systems and operational performance The negative impact is due to the increased complexity of the additional system resources required to maintain an acceptable level of performance. Hariri et al. (2019) highlighted the difficulty of efficiently

analysing unstructured and semi structured data that originates from a range of sources with several data types and representations. Jabbar, Akhtar and Dani (2020) stated that because of these difficulties, scholars describe big data as noisy, difficult to integrate, and of little strategic value. Shakil, Zareen, Alam and Jabin (2020) pointed out that healthcare data are growing at an exponential rate; it is estimated that these data will escalate to a value of 25,000 petabytes by 2020.

The challenge of data management is growing in complexity and intricacy, primarily due to the proliferation of data-intensive devices that generate unprecedented data volumes along with their associated workflows (Barisits, Beermann, Berghaus, Bockelman, Bogado, Cameron, Christidis, Ciangottini, Dimitrov, Elsing & Garonne, 2019). In healthcare data management, a significant challenge involves dealing with the storage and retrieval of large and diverse datasets, as well as the integration and sharing of such data distributed across various locations (Shakil et al., 2020). The lack of scalability poses a barrier to making operational and strategic decisions in health industry data management by limiting the amount of data that can be stored. This limitation can impede health professionals' ability to access and analyse extensive data sets, which is crucial for making well-informed decisions related to treatment planning and resource management. Miyachi and Mackey (2021) emphasize the importance of a scalable and high-throughput system capable of processing massive data volumes at relatively low computational costs for real-world clinical treatment. However, Lifhjelm (2021) mentioned that if an organisation wants to improve its servers or storage to accommodate larger datasets, the additional cost could be highly prohibitive. The purchase of new systems to accommodate scalability is likely to ensue in the lack of interoperability with existing legacy or even newer systems.

Heubusch (2006) defines interoperability as the capability of diverse information technology systems and software applications to communicate, ensuring the accurate, effective, and consistent exchange of data, which should subsequently be valuable. In contrast, Belchior, Vasconcelos, Guerreiro and Correia (2021) characterises interoperability as the semantic interdependence among distinct ledgers for the transfer or exchange of data or value, with assurances of validity. Siyal, Junejo, Zawish, Ahmed, Khalil and Soursou (2019) highlight persistent challenges in achieving interoperability, especially in the secure and successful exchange of clinical data between healthcare organizations or research institutions during practical operations. Several potential

constraints include the unique nature of clinical data, its sensitivity, data sharing agreements, intricate patient matching algorithms, ethical policies, and governing rules. These are critical considerations that must be mutually agreed upon before undertaking any practical clinical data exchange between data management systems (Belchior 2021).

According to González Morales and Orrell (2018), individual organizations typically make independent decisions about structuring their data and metadata assets, adopting storage and exchange models based on immediate operational needs without considering interoperability. This indicates a lack of coordinated attention to user needs at both technical and operational levels. In comparison to industries like media, finance, insurance, and retail, the healthcare sector has the least acceptance of digitalization, usage, and innovation, leading to limited improvements in labour productivity (Gopal, Suter-Crazzolara, Toldo & Eberhardt, 2019). The lack of interoperability in healthcare systems is a pressing issue that existing technologies can address, but the motivation to address it remains insufficient. Ultimately, without interoperability, it is difficult for different systems to share data in a standardised format, which can lead to data silos, inefficiencies, and errors in making informed operational decisions.

Zeadally, Siddiqui, Baig and Ibrahim (2020) identify data management challenges arising from the lack of standardized data collection formats and the substantial volume and speed of data produced in healthcare environments. The presence of legacy systems, diverse data sources with minimal adherence to data standards, data insecurity, and privacy apprehensions collectively impede the optimal utilisation of health information to maximize value for all stakeholders in the healthcare domain (Wang, Kung & Byrd, 2018). In the healthcare organization where I work, standardized data include demographics of patients, medical history, clinical information, etc. Examples: The demographic data of the patient includes the following: name, date of birth, address, phone number, gender, race, and ethnicity. Medical history includes previous medical problems, allergies, and current medications. Clinical data include vital signs, physical exam findings, and a diagnosis.

Incorrect data may result in misguided decisions and hinder successful long-term strategic planning. The challenge of comparing data across various sources and systems is exacerbated by the absence of standardized data collection formats, thereby impeding both operational and strategic decision-making in the field of data management (Jung,

Tran Tuan, Quoc Tran, Park & Park, 2020). Furthermore, conflicting standards cause conversion problems and data losses (Himanen, Geurts, Foster & Rinke, 2019). Ultimately, this can prevent decision-makers from making informed decisions based on reliable data. In addition, it can also result in costly errors when data are mistakenly entered or read from incompatible systems, making it difficult to assess the effectiveness of treatments and interventions.

1.3 PROBLEM STATEMENT

Despite the benefits of data management systems to enable the success of organizations, cybersecurity vulnerabilities, issues of infrastructure scalability, a lack of interoperability, and non-standardised data formats inhibits operational performance, as well as the extent of informed decision making (Bundesregierung, 2021).

These issues expose organization employees to imminent cyber-attacks, restrict access to and meaningful use of data and eventually lead to misinformation and disinformation during operational and strategic decision making by management (Jennex, Durcikova & Ilvonen, 2022). The situation is even worse in the healthcare sector, where sensitive data is collected that may not necessarily be accurate or complete. This data is used for life-impacting decisions and to determine actions on a regular basis.

If the issues highlighted are not adequately considered and addressed by vendors who develop and implement data management systems, uninformed decisions and the resulting suboptimal performance will lead to imminent failure of any organization.

1.4 AIM OF THE STUDY

The purpose of the study is to investigate and understand how vendors develop and implement data management systems to effectively address challenges related to cybersecurity vulnerabilities, infrastructure scalability, interoperability, and non-standardised data formats that impede data-driven organizational processes.

1.5 RESEARCH AIM, QUESTIONS AND OBJECTIVES

The aim of the research is to explore how vendors develop data management systems to address cybersecurity vulnerabilities, infrastructure scalability, interoperability, and non-standardised data formats that inhibit data-driven organisational processes.

1.5.1 MAIN RESEARCH QUESTIONS

How do data management systems vendors address the challenges that inhibit operational processes in organisations?

1.5.1.1 RESEARCH SUBQUESTIONS

I. How do vendors address the quality of the data management system to ensure scalability?

   Objective: To investigate how vendors address data management system quality to ensure scalability in organisations.

ii. What are the technical requirements for interoperability when implementing data management systems?

   Objective: To determine the technical requirements for interoperability when implementing data management systems in organisations.

iii. What are the overall net benefits attributed to data management systems?

   Objective: To assess the net benefits of data management systems.

iv. How can vendors improve data management systems to address the challenges of data-driven organisational processes?

   Objective: To identify how vendors can leverage data management systems to improve the efficiency and effectiveness of data-driven organisational processes.

1.6 SIGNIFICANCE OF RESEARCH

The research investigates crucial challenges hindering data-driven organizational processes, highlighting the impact of cybersecurity vulnerabilities, scalability issues, interoperability concerns, and non-standardized data formats. Understanding how vendors develop and implement data management systems to address these issues is of significance to improve organisational decision making, operational efficiency, and strategic planning. The significance of this research extends to various stakeholders involved in data management systems.

Organisations and Businesses: This study helps in operational enhancement. Understanding how vendors address data management challenges can directly impact

an organization's operational efficiency. Implementing effective systems can streamline processes and improve decision making. Insights into cybersecurity vulnerabilities and solutions can help organisations safeguard their data, reducing the risk of cyber threats and potential data breaches. Addressing interoperability and data format issues can lead to better-informed strategic decisions, leveraging accurate and standardised data across systems.

Vendors and Developers: The insights collected can guide vendors in improving the quality and scalability of their data management systems and meeting market demands more effectively. Understanding the technical requirements for interoperability can fuel innovation, enabling vendors to develop more seamless and compatible systems.

Technology and IT Professionals: Research findings can serve as a guide for IT professionals, offering insight into best practices and technical requirements for implementing robust data management systems.

Policy Makers and Regulators: Understanding the challenges and benefits associated with data management systems can influence policy development. It can lead to the establishment of better regulations and standards to ensure data security, privacy, and interoperability.

Academia and Researchers: The research contributes to the academic field by shedding light on practical challenges faced in real-world scenarios. It serves as a basis for further studies and exploration in the domain of data management systems.

Healthcare and public sector: Better data management practices can significantly improve healthcare services by ensuring accurate and standardised data for informed medical decisions, leading to better patient care and outcomes.

1.7 ABBREVIATED LITERATURE REVIEW

Zhu, Wu, Gai and Choo (2019) define data management systems (DMS) as a toolkit used by organizations to structure, store, retrieve and manipulate data. DMS, as highlighted by Duan, Edwards, and Dwivedi (2019), performs various functions, ensuring secure access, managing storage, organizing data, and effectively handling large volumes of structured data to maintain accuracy. Yassine, Singh, Hossain and Muhammad (2019) emphasize the importance of DMS in the efficient management of complex data within modern organisational settings.

Tabesh, Mousavidin, and Hasani (2019) argue that DMS serves as an intermediary between databases and users or software applications, creating a controlled environment for interaction. Additionally, Shamim, Zeng, Shariq and Khan (2019) mention that DMS facilitates simultaneous access by multiple users without conflicts, simplifying data management for both users and developers (Yassine et al., 2019).

Milat et al. (2020) note the revolutionary impact of DMS on data storage, retrieval, and utilization within organisations, offering advantages over traditional file systems. Fu and Soman (2021) highlight the role of DMS in ensuring accurate database updates and maintaining system reliability. Chiware and Mathe (2015) echo similar sentiments, emphasising DMS's support for concurrent user usage without conflicts, which impacts system efficiency and collaborative work.

Satti, Ali, Hussain, Khan, Khattak and Lee (2020) underscore the significance of proficient data management in attaining a competitive advantage within the contemporary data-focused business environment. They emphasize the pivotal role of a Data Management System (DMS) in managing substantial data volumes to facilitate well-informed decision-making processes. In the healthcare sector, as highlighted by Gopal et al. (2019), digitization and interoperability needs have led to advancements in data management systems. Electronic health records, clinical data warehouses, and analytics platforms facilitate data sharing, evidence-based treatment, and predictive analytics. The challenges in this sector, noted by Blizinsky and Bonham (2018), include obstacles to data privacy, security, and interoperability.

In addition, Blizinsky and Bonham (2018) emphasise how data management solutions streamline administrative tasks in healthcare, improving patient management, scheduling, invoicing, and inventory control. This automation reduces errors and improves operational efficiency. Malange (2023) underscores the role of data management systems in population health management and medical research within the healthcare sector.

1.8 LIMITATIONS OF THE STUDY

The qualitative approach of the study has limitations within it such as potential biases and limited generalizability. The study did not cover every aspect of data management systems due to the breadth of the subject. It focused on specific industries or regions, potentially overlooking broader perspectives. Access to comprehensive and up-to-date

information might be limited. Some vendors may not disclose proprietary information or may be reluctant to share specific details. However, participants will be told that the study is done for academic purposes only for them to express their views freely. The limited time for research could restrict the depth of analysis or exploration of all potential facets related to vendor practices and data management systems. Constraints in financial resources or access to certain technologies can restrict the scope or implementation of proposed solutions. The researcher will use her savings to overcome the challenges of resources and work extra to overcome the time challenge.

1.9 DELIMITATIONS OF THE STUDY

Delimitations in a research study refer to the boundaries, limitations, or restrictions within which the research is conducted. The study focuses on the Western Cape province in South Africa. The research limits its scope to a particular industry, which is healthcare due to their specific challenges in data management. The study focused on selected vendors or a specific category of vendors that provide data management systems, without providing a comprehensive overview of the entire vendor landscape. The methodology chosen for the study is interviews.

1.10 RESEARCH APPROACH

In this study, qualitative research approach was used. Qualitative methods allow for a comprehensive exploration of the complexities and contextual factors that influence data management systems. They offer detailed insights that quantitative methods might not capture. Given the diverse challenges in data management, qualitative research facilitates in-depth exploration of multifaceted issues, allowing nuanced interpretations and understanding of vendor strategies.

In addition, interviews were conducted with stakeholders who are actively involved in the development, implementation, and usage of data management systems. The primary objective of the interviews is to gather valuable information, opinions, and experiences to gain a comprehensive understanding of the challenges, strategies, and perspectives associated with data management. The application of thematic analysis facilitated the identification, examination, and reporting of themes present in qualitative data. This method entails the systematic organization and interpretation of data to recognize recurring patterns, essential issues, and insights pertaining to the challenges and strategies employed by vendors in the realm of data management systems.

1.11 ETHICAL CONSIDERATIONS

Informed Consent: This crucial ethical principle involves transparently outlining the purpose, procedures, potential risks, and benefits of the study to participants. It requires the voluntary agreement of the individuals involved in the investigation, highlighting their right to withdraw at any point without consequence.

Confidentiality and Anonymity: Upholding privacy standards involves safeguarding participants' identities and sensitive data. This involved employing secure data storage and dissemination practices to prevent unauthorized access and ensure that no identifiable information is revealed in the study reports or publications.

1.12 LAYOUT OF THE STUDY

Chapter One: Introduction

This section presents the background, problem statement, objectives, scope, and significance of the research. It establishes the context for the study, outline its purpose, and highlight the key areas of investigation.

Chapter Two: Literature review

In this chapter, existing scholarly works, theories, and studies relevant to the research topic are critically analysed and synthesized. It provides a comprehensive understanding of the subject, identifies gaps in knowledge, and justifies the importance of the study.

Chapter Three: Methodology

This chapter details the research design, methodology, data collection methods, and tools used to collect and analyse information. It explains the rationale behind the chosen approach and methods and discusses potential limitations.

Chapter Four: Findings and analysis

This chapter presents the collected data, analyses the findings, and interprets their significance in relation to the research questions or hypotheses.

Chapter Five: Conclusion and Summary of Key Findings

The concluding chapter provides a concise summary of the main findings of the study, reiterates the research objectives, discusses implications, and suggests areas for future research.

Chapter Six: Thesis conclusion and recommendations

This chapter wraps up the investigation by briefly outlining the practical, theoretical, and methodological implications of the study. It emphasizes the study's limitations and provides recommendations for potential future research.

1.13 CONCLUSION TO CHAPTER ONE

In the Introduction chapter, it was shown that the landscape of data management within organizations is intricate and integral, serving as a pivotal force in driving informed decision-making and operational efficacy. However, this pivotal function is significantly challenged by persistent hurdles, from cybersecurity vulnerabilities to scalability issues, interoperability limitations, and the lack of standardized data formats. The depth of these challenges underscores the critical role that data management system vendors must play in addressing and overcoming these obstacles. The forthcoming investigation seeks not only to unravel the methods employed by these vendors but also to discern the net benefits and potential enhancements that could fortify data management systems, ultimately amplifying the potency of data-driven organizational processes. The imperative lies in comprehensive understanding how vendors navigate these challenges to refine and fortify data management systems, empowering organizations to navigate the complexities of the modern data landscape. The focus of the following chapter is to discuss the literature review related to this study.

CHAPTER TWO: LITERATURE REVIEW – IDENTIFYING THE GAP

2.0 INTRODUCTION

In the contemporary landscape of organizational functionality, the criticality of efficient data management systems (DMS) cannot be overstated. These systems serve as the backbone for the handling, organization, and utilization of vast data pools within diverse sectors, influencing operational, strategic decision-making, and overall organizational efficiency. A comprehensive exploration of DMS, covering its evolution, advantages, purposes, applications, challenges, and theoretical underpinnings, presents a mosaic of insights into its multifaceted role within various industries.

This literature review embarks on a journey through the realms of DMS, commencing with an elucidation of data management systems' fundamentals, followed by an exploration of their advantages, purposes, applications in sectors such as healthcare education and finance, and the challenges they confront. The exploration culminates in an examination of the theoretical framework of DeLone and McLean's information systems success model, providing a lens through which the efficacy and success of these systems can be comprehensively evaluated.

2.1. DATA MANAGEMENT SYSTEMS

According to Zhu et al. (2019), data management system (DMS) is an organisation's use of a collection of tools, strategies, and procedures to organize, store, retrieve, and manipulate data. Duan et al. (2019) further highlight that data management systems perform various functions, such as enabling user access to data; ensuring its security; managing storage and organisation, and effectively working with substantial amounts of structured data to maintain accuracy. Yassine et al. (2019) stated that DMS provides a solid method for organising and efficiently working with data in today's complex and data-intensive organisational environments.

Tabesh et al. (2019) argues that DMS acts as an intermediary between databases and users or other software applications. DMS establishes a controlled and consistent environment for users to interact with databases, allowing them to retrieve, modify, and manipulate data using predefined operations. Furthermore, Shamim et al. (2019) mentioned that DMS enables multiple users to access data simultaneously without conflicts or errors. By abstracting the complexities of data storage and retrieval, DMS

simplifies data management for users and developers, promoting logical data organisation (Yassine et al., 2019).

Agrawal, Abbadi, Antony and Das (2010) reported that the origins of DMS trace back to the latter half of the twentieth century when IBM, a prominent information systems company, developed the first DMS known as Information Management System (IMS). According to Barisits et al. (2019), IMS changed data management by arranging data in a hierarchical form that resembles a tree structure. This technique improved data storage and retrieval efficiency and scalability, setting the groundwork for future developments in the field (Barisits et al., 2019).

2.1.1 ADVANTAGES OF DMS

The advantages of DMS are characterized by its main capabilities to store, process, and analyse a large amount of data. For example, Gopal et al. (2019) indicated that one of the key features of DMS is the ability to store vast amounts of data that are more than what humans can handle. Jabbar et al. (2020) highlight the capacity of DMS to efficiently handle and organise massive datasets using cutting-edge storage technology and optimized data structures. DMS are essential for applications that need substantial data storage because they offer scalable designs that store as much as petabytes of data (González Morales & Orrell, 2018).

Another advantage of DMS, according to Jennex et al. (2022), is the ability to combine several data sources into a single cohesive system. This benefit enables businesses to eliminate data silos and to have a comprehensive understanding of their information assets. DMS provides effective data exchange, enhanced data consistency, and thorough data analysis and integration. The integration strategy fosters cooperation, improves decision-making procedures, and enables data-driven insights across organisational divisions (Jabbar et al., 2020). In addition, Gopal et al. (2019) explains that DMS provides tools for managing and tracking changes to data that are stored to ensure data correctness and consistency. O'neal (2012) supports the above by stating that advanced features such as transaction management, concurrency control, and data versioning enable data modifications, rollbacks, and error recovery. According to Jennex et al. (2022), the ability to monitor and modify stored data in real time provides organisations with data integrity and ensures the dependability of the information system.

Miyachi and Mackey (2021) argue that in today's digital environment, data security and confidentiality are critical elements. DMS offers strong security methods to shield confidential information from unwanted access and guarantee total secrecy. Organisations can protect their data assets by establishing access control policies, encryption methods, and audit capabilities thanks to DMS. The security measures provided by DMS fosters stakeholder confidence, improves adherence to data protection laws, and reduces the risks connected with data breaches when transmitted or in storage.

To meet the increasing needs for real-time data processing, businesses must prioritize efficient data storage and retrieval. To provide high-speed data access, DMS uses indexing, caching, and query optimization methods (González Morales & Orrell, 2018). The efficiencies in data processing help businesses to quickly obtain and modify data, supporting quick decision making and improving system performance. The relevance of high-speed data processing can be observed in a variety of fields, including financial transactions, e-commerce, and scientific research (Gopal et al., 2019).

2.1.2 PURPOSES OF DMS

Milat et al. (2020) indicated that Data Management Systems (DMS) have revolutionised data storage, retrieval, and utilization within organisations. They offer significant advantages over traditional file systems, enhancing data management in a simpler and more reliable manner to enable informed decision making and enhancing organisation performance. According to Fu and Soman (2021), DMS ensures that database updates are executed correctly, guaranteeing that changes to data are either fully implemented or not implemented at all. The evaluation investigates the impact on data accuracy, error correction, and system reliability. Chiware and Mathe (2015) share a similar view that DMS support concurrent usage by multiple users without conflicts, employing methods to maintain data consistency. The assessment delves into how this affects system efficiency, collaborative work, and data handling capacity.

DMS has robust security features to protect data against unauthorized access and maintain confidentiality. Measures such as access controls, authentication, and encryption are employed. The review assesses the importance of security in adhering to data protection regulations and fostering trust within the organisation (González Morales & Orrell, 2018). Gopal et al. (2019) mentioned that DMS allows data access control, regulates data copying, provides a secure data repository, facilitates data manipulation

and modification, offers diverse methods of system utilization, and presents clear representations of complex data relationships.

2.2. USE OF DMS FOR OPERATIONAL AND STRATEGIC DECISION MAKING

According to Satti et al. (2020), effective data management and usage are now crucial for firms to obtain a competitive edge in today's data-driven business climate. Regarding collecting, storing, organising, and analysing massive volumes of data to support tactical and strategic decision-making processes, data management systems (DMS) are essential. The importance of DMS in improving organisational efficiency and promoting informed decision making is examined in this review of research.

2.2.1 ENHANCING OPERATIONAL EFFICIENCY

Satti et al. (2020) stated that DMS enables the establishment of a distributed environment capable of storing and enabling access to a significant amount of data, such as the data needed and produced by scientific computing studies performed in grids. According to Shakil et al. (2020), by integrating disparate datasets, the DMS allows enterprises to get a holistic picture of their operations and procedures. This centralized strategy enables the collection and compilation of data from numerous sources in a single location. As a result, data analysis and interpretation lead to better decision-making to improve productivity and a more holistic view of the organisation's activities (Gopal et al., 2019).

By implementing best practices and data validation techniques, DMS ensures accuracy, consistency, and reliability of the collected data (Shakil et al., 2020). This implies that the DMS has mechanisms in place to validate the accuracy and reliability of the data being collected. By maintaining data quality and consistency, organisations can rely on the information collected and confidently utilize it to make informed decisions about business operations that are underperforming. Clean and consistent data enable more accurate analysis, reducing the risk of making decisions on faulty or incomplete information (Shamim et al., 2019). Organisations can use DMS to access operational data in real-time, allowing them to analyse their performance and take informed actions. Real-time data availability facilitates rapid decision-making and enhances organisational responsiveness (Tabesh et al., 2019). Organisations can monitor and identify deviations from desired benchmarks and take immediate corrective actions (Shamim et al., 2019).

In terms of process automation, DMS reduces the need for manual intervention and minimizes the risk of errors by automating repetitive and routine tasks (Thach, Hanh, Huy

& Vu, 2021). This implies that DMS automate tasks such as data entry, document sorting, and workflow. By streamlining operational workflows through automation, organisations can eliminate time-consuming manual tasks and allocate resources to strategic activities. This improves operational efficiency and productivity while reducing the likelihood of errors that may arise from manual intervention (Fu & Soman, 2021). Subsequently, DMS simplifies data sharing and collaboration among different departments and teams within an organisation (Thach et al., 2021). It promotes communication across various areas of the organisation, improving coordination and leading to more effective decision-making processes and smoother operations. By enabling efficient collaboration, DMS fosters teamwork, knowledge sharing, and the utilization of collective expertise, ultimately improving operational efficiency (Gopal et al., 2019).

2.2.2 FACILITATING STRATEGIC DECISION MAKING

Duan et.al. (2019) evaluated the ability of Data Management Systems (DMS) to enable organisations to explore large volumes of structured and unstructured data, uncovering valuable information to support strategic decision-making. By using advanced techniques such as data mining and predictive modelling, organisations can discover patterns, trends, and connections within their data. This allows them to gain deep insights that drive decision making, improve operational efficiency, and seize new opportunities while organisational performance is being tracked (Jung et al., 2020). According to Miyachi and Mackey (2021), DMS gives businesses a set of tools for monitoring and evaluating key performance indicators (KPIs) and tracking progress toward strategic goals. Using these tools, organisations can effectively assess their performance, identify areas for improvement, and use data to make informed decisions about resource allocation (Matheus, Janssen & Maheshwari, 2020). Therefore, organisations are empowered to optimize their operations, increase productivity, and achieve goals with greater precision and efficiency.

DMS can enable risk management and facilitate understanding of market dynamics. For example, DMS offers comprehensive information on several factors, including operational, financial, and market conditions (Matheus et al., 2020). By thoroughly analysing and modelling risks, organisations can develop a comprehensive understanding of potential challenges and opportunities. Armed with this knowledge, they make informed decisions to minimize issues, mitigate risks, and capitalize on emerging opportunities. This proactive approach to risk management enables organisations to

navigate uncertain environments more effectively and protect long-term success (Fu and Soman, 2021). Furthermore, DMS equips organisations with the ability to collect, analyse and interpret market data, including customer preferences, competitor strategies, and industry trends (Gopal et al., 2019). By leveraging these insights, organisations can deeply understand market dynamics, customer behaviour, competitive landscape, product positioning, and expansion strategies (Jung et al., 2020). By aligning their operations with market realities, organisations can optimize market share, drive innovation, and maintain a competitive edge.

After managing risks and understanding market trends, DMS empowers organisations to simulate different strategic options and evaluate potential outcomes before implementing them in the real world (Jung et al., 2020). By conducting simulations based on robust data models and data-driven insights, organisations can assess the potential impact of decisions and strategies. As a result, organisations can reduce uncertainty, identify the most effective strategies, and make proactive decisions that maximize their chances of success (Matheus et al., 2020). Ultimately, DMS facilitates a more agile and adaptive approach to strategic decision making, enhancing organisational resilience and responsiveness in a rapidly changing business landscape.

2.3. APPLICATION OF DATA MANAGEMENT SYSTEMS

2.3.1 HEALTH SECTOR

Data management systems in healthcare have advanced because of digitization and the need for interoperability (Gopal et al., 2019). Electronic health record (EHR) systems, clinical data warehouses, and data analytics platforms are widely adopted. These technologies provide seamless data sharing among healthcare professionals, improve evidence-based treatment, and enable predictive analytics for disease prevention and patient outcomes. However, challenges such as data privacy, security, and interoperability remain significant obstacles (Blizinsky & Bonham, 2018).

Data management solutions are also essential for simplifying administrative procedures in the healthcare industry (Blizinsky & Bonham, 2018). These technologies enable healthcare organisations to handle patient demographics, scheduling, invoicing, and inventory management more effectively. By automating these procedures, data management solutions reduce administrative burdens, eliminate errors, and improve overall operational effectiveness in healthcare settings (Gopal et al., 2019). Malange

(2023) said that data management systems help with population health management and medical research.

By safely capturing and analysing large volumes of data, these technologies enable researchers to discover patterns, trends, and risk factors associated with various diseases. This knowledge, according to Zamboni et al. (2019), can be used to make educated policy decisions and develop preventive approaches. Furthermore, Blizinsky and Bonham (2018) stated that DMS helps researchers combine data from multiple sources, such as EHRs, clinical trials, and public health databases, allowing researchers to conduct comprehensive studies and gain a deeper understanding of complex health issues.

2.3.2 EDUCATION SECTOR

Data management systems are increasingly being utilized in education to improve teaching and learning, simplify administrative processes, and customize education. These systems assist educational institutions in collecting, organizing, analysing, and utilizing data to make more informed decisions and run more efficiently (Majola & Mudau, 2022). Learning management systems (LMS) are one prominent application of data management systems in education. LMS platforms enable teachers to build and deliver online courses, as well as track and evaluate student progress. These systems serve as a central repository for instructional resources, assignments, and assessments. Teachers can readily observe how each student performs, identify areas where they need help, and change their instruction accordingly with LMS.

In addition, data management systems help to collect and analyse student data, such as attendance records, grades, and demographic information. This information can be used to uncover patterns and trends, assess student performance, and drive interventions or support methods (Matheus et al., 2020). Teachers, for example, can use data analytics tools to identify students who may be underperforming or to forecast future educational outcomes based on previous data. These data enable targeted assistance and personalised support to increase student success rates. Administrative tasks in educational institutions also benefit from data management systems. These systems automate tasks such as student registration, scheduling, and resource allocation. Educational institutions can save time and costs, minimize errors, and increase overall

efficiency by centralizing data and automating administrative operations (Majola & Mudau, 2022).

Emerging innovations such as artificial intelligence (AI) and machine learning (ML) have the potential to change data management systems in education. AI-powered solutions can automate data analysis, identify patterns, and deliver personalized recommendations to students and teachers. ML algorithms can predict student performance and recommend personalised learning routes based on their strengths and weaknesses (O'neal, 2012). Furthermore, blockchain technology allows for the secure storing and verification of educational certificates, allowing for everlasting records of learning and eliminating the need for centralized repositories.

2.3.3 FINANCE SECTOR

Data management systems are critical in the finance sector for handling massive volumes of financial data, guaranteeing regulatory compliance, and enabling risk management (Chang, Baudier, Zhang, Xu, Zhang & Arami, 2020). Data warehouses, data lakes, and data governance frameworks are widely used. These technologies offer real-time data processing, fraud detection, customized consumer experiences, and algorithmic trading. However, obstacles such as data quality, integration, and regulatory constraints pose difficulties (Calliess & Baumgarten, 2020). Data management systems are also necessary in the financial business to facilitate data analysis and decision-making procedures. Financial institutions can employ these systems to examine historical and real-time data to uncover trends, patterns, and correlations that can influence investment strategies, risk assessment models, and portfolio management (Varga et al., 2021; Warikandwa, 2021).

Data management systems also help the banking industry increase customer engagement and satisfaction. Through effective data integration and analysis, financial institutions can gain a comprehensive insight of their consumers, including their preferences, behaviours, and financial needs. Thus, enabling customized financial services, personalised marketing activities, and product recommendations that address specific client demands (Li & Liu, 2021).

2.3.4 MANUFACTURING SECTOR

Data management systems are critical in the manufacturing sector for efficient production operations, supply chain management, and quality control. Manufacturing execution

systems (MES), enterprise resource planning (ERP) systems, and data analytics tools are adopted (Gopal et al., 2019). These technologies allow real-time monitoring, predictive maintenance, inventory optimization, and process optimization, as well as the management of supply chain disruptions. However, challenges arise from integrating legacy systems, standardizing data, and scaling the systems effectively (Warikandwa, 2021).

2.3.5 RETAIL SECTOR

Data management solutions are critical in the retail industry to understand customer behaviour, optimize inventory management, and improve the shopping experience; similar to the finance sector (Zhu et al., 2019). Customer relationship management (CRM) systems, point of sale (POS) systems, and data mining techniques are frequently employed. These technologies allow customized marketing campaigns, demand forecasting, supply chain optimization, and recommendation engines. However, obstacles such as privacy issues, data silos, and the need for real-time data analysis offer challenges (Yassine et al., 2019).

In general, data management systems are widely used and important in a variety of industries to improve decision making, operational efficiency, and innovation. However, challenges remain with respect to data privacy, interoperability, data quality, and system integration.

2.4. CHALLENGES OF DATA MANAGEMENT SYSTEMS

2.4.1 SPORADIC LOAD CHARACTERISTICS AND INCREASING DEMAND FOR DATA STORAGE

Although cloud computing and cloud apps are very popular, Pandit and Agrawal (2022) discovered that they have several drawbacks. In their examination of the obstacles to the Internet of things, Patel et al. (2016) discovered that one of the major issues is the irregular and erratic nature of the data load. The volume of data recorded and retained might vary greatly, with busy times followed by slower ones. Data management systems must be developed to handle these irregular load patterns efficiently while always ensuring data availability. A solid infrastructure and sensible resource allocation are required to scale up or down depending on demand (Singh et al., 2022).

The challenges highlighted by Pandit and Agrawal (2022) and Patel et al. (2016) regarding cloud computing, cloud apps, and the irregular nature of data load can have significant repercussions for the functionality of data management systems (DMS) in organisations. These challenges have several consequences. First, performance issues can arise due to unpredictable data load, resulting in bottlenecks and slowdowns during peak periods, which can cause delays in data processing, retrieval, and analysis.

Second, scalability becomes a challenge as DMS need to efficiently handle varying data load patterns by scaling resources up or down. Poor infrastructure and resource allocation can lead to performance degradation, wasted resources, and increased costs. Third, ensuring data availability and reliability becomes crucial, but can be jeopardized by irregular data load, potentially causing data loss or unavailability during sudden surges.

Fourth, managing irregular data loads adds complexity to the system architecture, necessitating the implementation of sophisticated load balancing mechanisms, dynamic resource allocation algorithms, and intelligent data management strategies. This complexity requires expertise, specialized skills, and additional resources, which pose challenges to organizations. Finally, inefficient resource allocation and scalability can lead to increased costs, with over-provisioning resulting in unnecessary expenses, and under-provisioning causing performance degradation and potential revenue loss. Optimising resource allocation based on data load patterns is essential for cost-effective DMS operation.

2.4.2 CONSISTENCY REQUIREMENTS

According to Siyal et al. (2019), different cloud-based apps have varying needs for data consistency. For example, some applications allow for eventual consistency, in which data changes spread gradually, while other specific applications require strict consistency, in which all users must view the same data at the same time. In both e-Learning management systems and banking systems, data consistency plays a vital role in ensuring accuracy and reliability (Tahar et al., 2020). In e-Learning platforms, two approaches to data consistency are discussed (Pandit & Agrawal, 2022). Eventual consistency is acceptable when multiple users can access and update course materials, as long as consistency is achieved within an acceptable timeframe.

Strict consistency is necessary in collaborative real-time coding environments to ensure that all users see the same code simultaneously. In banking systems, eventual

consistency can occur during transaction processing, ensuring that transactions will eventually be correctly reflected in all accounts (Purwati, Mustafa & Deli, 2021). Strict consistency is crucial for managing account balances and handling concurrent transactions to prevent financial discrepancies and customer dissatisfaction. It is important to consider that data consistency mechanisms can vary based on specific requirements, infrastructure, and architectural design of each system (Pandit & Agrawal, 2022).

2.4.3 MIGRATION OF WEB APPLICATIONS TO THE CLOUD

According to Siyal et al. (2019), there are new challenges when migrating web applications from traditional on-premises infrastructure to the cloud. These apps used to run on expensive specialized hardware, but today they run on more flexible and cost-effective cloud infrastructure (Singh et al., 2022). Data management solutions must adapt to the additional burdens and expectations that come with running applications in a distributed environment. They must manage data correctly and ensure that the cloud infrastructure is integrated (Pandit & Agrawal, 2022).

2.4.4 DIFFICULTY IN ACCESSING, MODIFYING, AND SEARCHING LARGE FILES

Traditional data management in legacy systems is unable to handle large files; this is associated with many information inefficiencies (Singh et al., 2022). The rise of big data has increased the demand for systems capable of efficiently accessing, modifying, and searching through these massive datasets. Data management systems must provide appropriate methods and approaches to optimally use memory resources for quick and accurate access, modification, and search activities (Gopal et al., 2019). The magnitude of big data may make conventional approaches and structures ineffective.

2.4.5 DATA PRIVACY

Data privacy is a critical concern in the implementation of data management systems (DMS) in the field of education. Singh et al. (2022) emphasizes the importance of ensuring data privacy and security within educational institutions. As educational institutions increasingly digitize student records and use online learning platforms, they accumulate substantial volumes of sensitive student data, including personal information, academic records, and occasionally even biometric data. To protect student privacy, educational institutions must adhere to stringent privacy regulations such as the Family Educational Rights and Privacy Act (FERPA) in the United States or the General Data Protection

Regulation (GDPR) in the European Union (Pandit & Agrawal, 2022). These regulations require institutions to obtain informed consent from students or their guardians prior to collecting and using their personal data. They also impose restrictions on data sharing and require secure storage and transmission of data to prevent unauthorized access (Mustafa et al., 2021).

The challenge lies in effectively implementing and complying with these privacy regulations. Educational institutions must invest in robust data protection measures, including encryption, access controls, and regular security audits, to protect student data. Furthermore, it is crucial to ensure that staff members receive adequate training on data privacy and security practices to prevent data breaches and unauthorized access (Mustafa et al., 2021). In addition to data privacy concerns, data incorrectness presents another challenge to the utilization of data management systems in education. Pandit and Agrawal (2022) emphasize the importance of data quality in educational decision making. Inaccurate or incomplete data can lead to flawed analyses, incorrect assessments of student performance, and misguided interventions.

One contributing factor to data incorrectness is the reliance on manual data entry, which can introduce human errors. Educational institutions often manage large amounts of data from various sources, including student information systems, learning management systems, and assessment platforms. If data are entered or recorded incorrectly at any stage, it can propagate throughout the system, resulting in data inconsistencies and erroneous conclusions (Singh et al., 2022). To mitigate data incorrectness, educational institutions should focus on improving data entry processes, implementing data validation mechanisms, and performing regular data audits. Techniques such as data cleansing and error detection algorithms can help identify and correct errors. Furthermore, automated data integration processes that eliminate the need for manual data entry can reduce the likelihood of data incorrectness (Mustafa et al., 2021).

Furthermore, interoperability issues pose a significant challenge to the effective use of data management systems in education. Singh et al. (2022) highlights the necessity of integrating data from various sources to gain a comprehensive understanding of students' educational journeys. However, educational institutions often employ multiple systems and platforms that may not communicate with each other seamlessly. Interoperability challenges arise due to disparities in data formats, data models, and system

architectures. For example, student information systems can store data in a different format compared to learning management systems or assessment platforms, making it difficult to combine and analyse data effectively. The lack of interoperability impedes data sharing and integration, thus hindering the ability to create a holistic view of student progress and performance (Mustafa et al., 2021).

To address interoperability challenges, educational institutions can adopt standardized data formats such as the IMS Global Learning Consortium's Learning Information Services (LIS) or the Experience API (xAPI). These standards facilitate data exchange and interoperability between different educational systems. Additionally, the use of application programming interfaces (APIs) enables seamless integration between various platforms, allowing data to flow securely and efficiently (Singh et al., 2022).

2.5. THEORETICAL UNDERPINNING

Default authentication is still widely used, and insecure web-based interface access expands the attack surface (Satti et al., 2020). To overcome this issue, clear and comprehensive regulations must be implemented to prevent illegal access. The problem is worsened by the growing number of devices connected to the Internet. Surprisingly, data breaches in healthcare and medical businesses are more common than in the financial, governmental, or educational sectors (Zeadally et al., 2020). Because the financial sector and its systems are more interwoven and interdependent than those of many other industries, it is an attractive target for cybercriminals. A cyberattack can quickly spread across players in the financial system, and the industry's security is only as good as its weakest link (Calliess & Baumgarten, 2020). Virtual banking, data sharing, artificial intelligence (AI), social networks, and cloud computing have created new problems and weaknesses in the financial services business, creating considerable opportunities for cybercriminals (Warikandwa, 2021).

To understand the complex relationship between the factors that ensure the success of information systems (IS) such as DMS, it is imperative to consider suitable theoretical frameworks that unpack the information, system, and user variables. For this reason, the DeLone and McLean IS success model has been selected and described in the subsequent section, then contextualized in relation to the current study.

2.5.1 THE DELONE AND MCLEAN INFORMATION SYSTEMS SUCCESS MODEL

The DeLone and McLean Information Systems Success Model (D&M IS Success Model), created in 1992 by William DeLone and Ephraim McLean, is a widely used theoretical framework for understanding and evaluating the success of information systems (IS) within organisations (Purwati et al., 2021). This model has been widely cited and used in both research and practical applications. The D&M IS Success Model presents six interconnected dimensions for measuring an information system's success. These are system quality, information quality, service quality, use, user satisfaction, and net benefits.

The quality of the system emphasizes the technical aspects of the information system, encompassing elements such as reliability, usability, flexibility, security, and functionality. System quality assesses how well a system meets its users' technical requirements and expectations (Hidayah, Putri, Musa, Nihayah & Muin, 2020). Information quality refers to the properties of information provided by the system, such as correctness, completeness, relevance, timeliness, and understandability. High quality information is essential for effective decision-making and problem-solving activities (Çelik and Ayaz, 2022). The support and assistance provided to the users of the information system is called service quality. It encompasses factors such as responsiveness, reliability, competence, courtesy, and empathy exhibited by support staff or IT personnel (Hidayah et al., 2020). The degree to which individuals utilize the information system to execute their activities and achieve their goals is measured by use. It measures the acceptance of the system by users and the level of engagement with its functionalities towards satisfaction (Purwati et al., 2021).

User satisfaction reflects the subjective evaluation of the information system by its users (Purwati et al., 2021). Satisfaction is influenced by the user's perception of the system's usefulness, ease of use, and overall experience. Satisfied users are more likely to continue using the system and recommend it to others (Hidayah et al., 2020). Subsequently, Net benefits encompass the positive outcomes and impacts that result from the utilization of the information system. These benefits can be tangible (e.g., increased productivity, cost savings) or intangible (e.g., improved decision making, improved communication). Net benefits provide an overall assessment of the system's contribution to the organization (Purwati et al., 2021). According to the D&M IS Success

Model, positive relationships exist between system quality, information quality, service quality, and use, leading to user satisfaction (Purwati et al., 2021).

In conclusion, DeLone and McLean's IS success model provides an applicable framework for understanding and evaluating information system success. Organisations can better evaluate and improve their IS operations considering the quality of the system, the quality of the information, the quality of the service, the use, the satisfaction of the users and the net benefits. However, it is important to acknowledge that the D&M IS Success Model has also faced criticism and limitations. Some argue that it predominantly focuses on user satisfaction and net benefits, neglecting other significant aspects, such as social and organisational impacts. Furthermore, the model does not explicitly address the role of contextual factors, such as organisational culture, which can influence the success of information systems (Hidayah et al., 2020).

2.5.2 APPLICATION OF IS SUCCESS MODEL IN EXISTING STUDIES

Various authors agree on applications of IS success model in different setups. In the study by Mlitwa and Ogundaini (2022) to determine the satisfaction of the e-Learning user at a South African University of Technology, it was found that the learners expressed positive experiences that LMS met their immediate academic needs. The difficulties encountered in the learning process were not attributed to the LMS's quality but rather to insufficient facilitation conditions and contextual nuances. Another study conducted by Çelik and Ayaz (2022) focused on validating the Delone and McLean IS success model. This research assessed the success of the Student Information System (SIS) using the updated Information System Success Model proposed by Delone and McLean. The empirical findings indicated that the system's quality, information quality, and service quality significantly influenced its use. However, these factors did not significantly impact user satisfaction. Additionally, both system use, and user satisfaction did not have a notable effect on the success of the SIS. Consequently, it would be advantageous for higher education institutions to assess the accomplishments of existing SISs to enhance their utilization and satisfaction among students.

Yakubu and Dasuki (2018) assessed e-learning success in developing countries. The study outcomes revealed a noteworthy correlation between software quality and information quality, directly influencing behavioural intention. Moreover, the research established that service quality significantly affects user satisfaction in a statistically

significant manner. Furthermore, both user satisfaction and behavioural intentions were identified as having a substantial impact on the actual usage. Another study was done by Veeramootoo, Nunkoo, and Dwivedi (2018) on success determinants of an e-government service. The study found that the drivers of perceived user satisfaction are information quality, system quality, instructor attitude, diversity in assessment, and perceived interaction with others.

The six concepts of the IS success model offer a suitable theoretical lens for tackling challenges in data management systems. System quality will ensure robust security measures and scalable infrastructure to address cybersecurity vulnerabilities. Information quality involves data governance practices and assurance measures to improve accuracy and reliability. User satisfaction prioritizes user experience and feedback for informed decision making. System use promotes adoption through training, optimizing operational performance, and positive organizational culture. Applying these concepts helps organisations gain net benefits in the form of improved data management systems, enhanced decision making toward achieving optimal performance.

2.6 CONCLUSION TO CHAPTER TWO

The importance of data management systems, as delineated in this review of the literature, unveils their indispensability in contemporary organisational frameworks. From their foundational roles in data organisation and their pivotal contributions in operational and strategic decision-making, DMS emerge as the linchpin of efficiency and informed action. The advantages they offer, ranging from scalable data storage to enhanced data consistency and concurrent usage, underscore their pivotal role in modern business landscapes. Their applications in sectors like healthcare and education not only streamline operations, but also pave the way for innovative advancements and improved outcomes in patient care and educational practices. However, despite these advancements, challenges persist. The erratic nature of the data load, security vulnerabilities, and evolving technological landscapes pose hurdles that require continuous evolution and adaptation of these systems. To understand their success and impact, the DeLone and McLean information systems success model stands as a robust framework, shedding light on dimensions crucial for evaluating and enhancing DMS efficacy. The following chapter is Chapter three that will focus on research methodology of the study.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 INTRODUCTION

Research methodology refers to the methods, techniques, and tools used to find, collect, process, and analyse data for a study (Saunders, Lewis, Thornhill & Bristow, 2019). Babbie and Mouton (2001) emphasized that research methodology explains the reasoning behind the methods used and why specific techniques are chosen, so that the researcher and others can evaluate the findings. This section will present the methods and technique adopted by the researcher to explore how vendors develop data management systems to address cybersecurity vulnerabilities, infrastructure scalability, interoperability, and non-standardised data formats. Subsequently, the research approach, the participants selection, and the methods used to collect and analyse the data are presented. The goal is to interpret the research findings effectively to address the research problem.

3.1 TIME HORIZON

The time horizon refers to the time frame over which a study is conducted, or the period covered by the research (Newman & Gough, 2020). It determines the scope and duration of the study, providing a temporal context for the research findings.

3.1.1 CROSS SECTIONAL

The cross-sectional study is a type of observational research design that aims to collect data from a specific population at a particular point in time (Snyder, 2019). It involves gathering information about different variables of interest simultaneously to understand their relationship within the given population (Wang & Cheng, 2020). Cross-sectional was selected as it is efficient and requires fewer resources, allowing researchers to collect data from a large sample size in a shorter period (Snyder, 2019). Cross sectional is cost-effective as it focuses on a single point in time, eliminating the need for long-term tracking and follow-up. For this study, a cross-sectional time horizon has been selected because it is a resource-effective approach, especially given the time constraint allocated to the researcher to complete the thesis module towards obtaining a post-graduate degree.

3.2 RESEARCH STRATEGY

A research strategy is a plan that a study follows (Patel & Patel, 2019). Research strategy refers to a systematic and deliberate plan of action designed to guide and organize the research process. It is a comprehensive framework that outlines the overall approach,

methods, and techniques to be used to address specific research questions or objectives. Examples of research strategies include grounded theory, ethnography, interview, survey, and case study (Flick, 2018).

For this study, a case study was adopted as discussed in the next section.

3.2.1 CASE STUDY

For this study, a single case study design will be used. A single case study is characterized by the in-depth analysis of a single individual, event, or phenomenon. (Thanem & Knights, 2019). In other words, the study focused on a specific company or a limited area. Case study research involves a comprehensive examination of the subject being studied (Snyder, 2019). It is a research method that provides a comprehensive and in-depth understanding of complex problems in their real-life context. For example, in this study the researcher will 'what are the attributes of a single case study applicable to exploring how vendors develop data management systems to address cybersecurity vulnerabilities, infrastructure scalability, interoperability, and non-standardised data formats that inhibit data-driven organisational processes. Case studies are especially valuable for understanding complex real-world situations within their unique contexts, helping researchers uncover influential factors.

3.3 RESEARCH METHOD

The research method refers to the systematic approach used to investigate, study, or analyse a particular topic or problem to gather relevant information and generate new knowledge or insights (Saunders et al., 2019). According to Wang et al. (2020) the research method can be categorized into quantitative, qualitative, and mixed methods. This study employed a qualitative research methodology, which involves a systematic approach to grasping individuals' experiences and internal emotions (Pandey & Pandey, 2021). It provides a comprehensive and in-depth exploration of a phenomenon by gathering data and presenting a detailed description through a flexible research approach (Mukherjee, 2019). The qualitative method specifically focuses on gathering nonnumerical information (Bloomfield et al., 2019). The choice of the qualitative research method was based on its suitability for investigating the attitudes of the respondents, requiring a detailed description to comprehend their reality. This approach enables the researcher to understand, identify, and gather soft data such as emotions and decisions, as well as insights into the social relationships among individuals in the same environment

(Cronje, 2020). The qualitative method is suitable for this study because it enables the researcher to explore vendor experiences and opinions and get in-depth information on how they address the challenges that inhibit operational processes in organisations.

In qualitative research, data collection instruments or tools are used to gather information through non-numerical means, focusing on understanding the perspectives, experiences, and meanings attributed by individuals or groups (Cypress, 2018). Several commonly used data collection instruments in qualitative research include interviews, focus groups, observations, and document analysis. Each instrument offers unique advantages and is suitable for different research contexts (Mukherjee, 2019).

In this study a semi-structured interview was selected. Semi structured interviews involve a flexible, yet guided conversation between the researcher and the participant(s) (D'Alimonte, Sio & Franklin, 2020). This approach allows open-ended questions, while also having a predefined set of topics or themes to explore (Cypress, 2018). This type of interview provides detailed and in-depth information on participants' experiences, perceptions, and interpretations.

Researchers can dive into complex issues and obtain nuanced insights. The semi-structured nature of the interviews allows the researcher to adapt and explore emerging themes or follow-up on interesting points raised by participants. This flexibility enables a deeper understanding of the research topic. Interviews provide a platform for participants to share their own viewpoints and narratives, allowing their voices to be heard and their experiences to be understood (Mukherjee, 2019).

3.3.1 SAMPLING

A population refers to a group of individuals from whom a smaller group, called a sample, is selected for a research study (Berndt, 2020). In most cases, it is not feasible to involve the entire population in the study, so a representative subset is chosen for data collection. For this study, the population consists of employees who work in the organisation under study. The study population includes 65 employees of the organisation. The sample, on the other hand, is a smaller group selected from the population and data was collected from this sample to carry out the research (Lobe, Morgan & Hoffman, 2020).

Sampling can be conducted through random and non-random sampling techniques (Cypress, 2018). To select the participants for the study, a non-random purposive

sampling technique will be used. Non-random sampling is a method used to select participants or data points for a study or analysis without relying on randomization. Instead, it involves a deliberate and purposeful selection process based on specific criteria or characteristics (Cronje, 2020).

In the context of studying the involvement of vendors in improving data management systems and organisational processes, non-random sampling can be employed to choose vendors for the study. Using non-random sampling in this study was done to pick vendors who have a proven track record in developing data management systems or those who specialize in addressing challenges related to data management. Factors such as vendor reputation, expertise, or availability of specific features or functionalities in their products may also be considered. This selection approach allows them to focus on vendors with experience and expertise in addressing specific issues, enhancing the relevance and applicability of their findings.

Purposive sampling technique was employed, which entails intentionally choosing individuals who meet criteria pertinent to the study (Bairagi & Munot, 2019). This method is a nonprobability sampling approach utilized in research to select participants based on specific characteristics or qualities relevant to the research objectives.

Purposive sampling involves deliberately choosing individuals or groups who possess certain attributes or meet specific criteria (Flick, 2018). In the context of the role of vendors in addressing the challenges of data management systems toward improving data-driven organizational processes, purposive sampling can be utilized to select vendors who have expertise and experience in data management solutions. This approach enables researchers to gain valuable insights from vendors who are well equipped to address challenges and improve data-driven organizational processes.

In this study, ten individuals were selected from the population of 65 to participate. The sample included four managers and six nonmanagerial employees. The inclusion criteria for the participants required a minimum of two years of work experience at the organisation, as well as knowledge and information about data management systems.

3.4 RESEARCH APPROACH

A research approach refers to how the researcher intends to make sense of the data collected from the field of study towards addressing the research problem (Mahat-Shamir, Neimeyer & Pitcho-Prelorentzos, 2021).

3.4.1 DEDUCTIVE APPROACH

This study employed a deductive approach, which adopts a top-down process where researchers initiate with a theory or hypothesis and subsequently test it against empirical evidence (Mukherjee, 2019). Deductive reasoning progresses from general principles or theories to specific observations or conclusions. The research utilized The DeLone and McLean Information Systems Success Model, thus applying a deductive approach.

The deductive approach is suitable for testing or exploring an existing theory in a specific context. It allows the collection of qualitative data to evaluate the theory's applicability and validity. The deductive approach is beneficial when there is preliminary evidence or previous studies suggesting relationships or patterns, confirming, or validating these initial findings (Mukherjee, 2019). Finally, it provides clarity and direction by addressing specific research questions or hypotheses, ensuring effective achievement of research objectives.

3.5 DATA ANALYSIS TECHNIQUE

Data analysis techniques encompass the methods, processes, and procedures employed for the examination and interpretation of data, enabling the derivation of meaningful insights and informed decision-making (Mahat-Shamir et al., 2021). In this study, the analysis of data collected from participants utilized thematic analysis. Thematic analysis is a method that facilitates the categorization of themes and patterns within a dataset, aligning with the research question (Lobe et al., 2020). It is a versatile approach enabling researchers to easily analyse participants' responses, employing a bottom-up approach to identify themes. The analysis referred to audio recordings of interviews, with the researcher developing themes based on the content. Throughout the audio analysis process, the researcher took notes as physical records. These notes were then refined and presented in a narrative form within the study's context.

This study used thematic analysis to explore how vendors develop data management systems to address cybersecurity vulnerabilities, infrastructure scalability, interoperability, and non-standardized data formats, which hinder data-driven organizational processes.

Thematic analysis facilitated the identification and categorization of themes and patterns related to the challenges and approaches used by the vendors.

3.6 ETHICAL CONSIDERATIONS

Ethical considerations refer to principles and practices that ensure the protection of participants' rights, well-being, and privacy throughout a study (Flick, 2018). In this investigation, the following ethical guidelines were meticulously followed to protect these considerations:

3.6.1 INFORMED CONSENT

Informed consent was prioritized to ensure that participants willingly and voluntarily chose to participate in the study without any form of coercion (Lobe et al., 2020). Participants were notified that they can withdraw from the study at any time if they feel uncomfortable, without repercussions, consequences, or penalties, and that any data acquired from them would be destroyed. To achieve this, participants were required to give their explicit consent by signing a consent form. This process ensured that they were fully aware of the purpose, procedures, potential risks, and benefits of the study before deciding to participate.

3.6.2 CONFIDENTIALITY AND PRIVACY

The researcher demonstrated a paramount commitment to confidentiality and privacy to protect the rights of the participants (Mukherjee, 2019). Personal information about participants will be treated with the utmost respect and will remain strictly confidential. The research complies with the South African Privacy Law, called the Protection of Personal Information Act. To maintain anonymity, the transcribed scripts were assigned unique identifiers that represent each participant's identity. Using this method, the confidentiality of the participants was effectively preserved. The study report will be carefully designed to ensure that no individual participant could be identified or linked to the research results, further safeguarding their privacy.

3.6.3 DATA MANAGEMENT

Stringent measures were adopted to guarantee the safety and security of the gathered data. The researcher meticulously stored the transcribed data in a secure, lockable safe, protected by a password, and accessible solely by the researcher. Through the implementation of robust physical security measures, the potential for unauthorized 45

access or data breaches was considerably minimized, thereby upholding the integrity and privacy of the participants' data.

3.6.4 FEEDBACK

Participants received clear information and assurance about the purpose and use of the collected data. They were informed that their data were used exclusively for academic purposes and shared only with relevant stakeholders involved in the investigation. Additionally, participants were assured that they would have access to all information related to the study if they wanted to review it. To ensure the ethical integrity of the study, research activities were suspended until the UNISA SBL grants the required ethical clearance certificate, ensuring that the research adhered to the highest ethical standards.

A. DELINEATION OF THE STUDY

The study focuses on the role of vendors in addressing the challenges of data management systems towards improving data-driven organizational processes. Specifically, it examines how vendors develop data management systems to address cybersecurity vulnerabilities, infrastructure scalability, interoperability, and no standardized data formats. The study adopts a qualitative research method, with a case study design focusing on a specific organization. The research involved conducting semi structured interviews with fifteen participants, including managers and nonmanagerial employees who have a minimum of two years of working experience and knowledge of data management systems. Thematic analysis was used to analyse the data collected from the interviews. The study adheres to ethical considerations and follows informed consent, confidentiality, privacy, and data management practices.

B. SIGNIFICANCE & CONTRIBUTIONS OF RESEARCH

PRACTICAL SIGNIFICANCE

The findings of the study can provide insight for vendors in developing data management systems that effectively address identified challenges, thus improving organisational processes. Research can help organisations understand the role of vendors and make informed decisions when selecting and collaborating with vendors for data management systems. The study can identify the best practices and strategies employed by vendors to overcome challenges, which organisations can apply to enhance their data-driven processes.

METHODOLOGICAL SIGNIFICANCE

The study contributes to the existing body of knowledge by employing a qualitative research method, specifically a case study design, to explore the role of vendors in data management systems. It demonstrates the application of thematic analysis as a data analysis technique to identify patterns and themes in qualitative data, offering insights into the effectiveness of this method in studying complex organisational phenomena.

THEORETICAL SIGNIFICANCE

The research extends the theoretical understanding of the role of vendors in addressing data management challenges by examining real-life experiences and perspectives of employees within an organisation. It may contribute to the development or refinement of existing theories or models related to data management systems and their impact on organisational processes. The study provides a contextualized understanding of how vendors' efforts impact data-driven processes, thereby enriching the theoretical foundations in this domain.

In the context of the study, the Delone and Mclean IS success model can help evaluate the success of data management systems in addressing the challenges facing organisations. By examining real-life experiences and perspectives of employees within an organization, the study can assess the quality of the system and the quality of the information provided by vendors, the extent of the use of the system, and the satisfaction of users. It can also explore the individual and organisational impacts resulting from the use of these systems. The DeLone and McLean information systems success model can be linked to the theoretical significance of the study by providing a framework to assess the impact of data management systems on organizational processes.

C. TIMELINES

The study will be organized according to the following schedule:

Activity:	**Deadline:**
Proposal	27-June-2023
Chapter 1	5-July-2023
Chapter 2	15-July-2023
Chapter 3	1-August-2023

Ethical clearance approval	5-August-2023
Chapter 4	15-August-2023
Chapter 5	7-September-2023
First draft	10-October-2023
Final draft	15-October-2023
Research submission	24-December-2023

3.7 CONCLUSION TO CHAPTER THREE

Chapter three provides a research methodology for the study of exploring vendors' approaches to developing data management systems addressing various challenges. The chapter delves into crucial aspects such as time horizon, research strategy, method, approach, data analysis, ethical considerations, study delineation, significance, contributions, and timelines. It meticulously describes the methods used, the rationale behind the choices and the ethical guidelines adhered to during the research process.

The depth of information covered in this chapter is substantial. It articulates the importance of employing a qualitative approach, specifically using a case study design and thematic analysis to unravel the intricacies of vendors' roles in managing data challenges. Moreover, ethical considerations are meticulously outlined, ensuring the protection of participants' rights and privacy. In conclusion, this chapter serves as the foundation of all research, setting the stage for the methodology used, the ethical standards followed, and the timelines established for completion. It aligns the objectives and goals of the study with the methodologies applied, demonstrating a comprehensive understanding of the research process. The following chapter will focus on data interpretation and analysis.

CHAPTER 4: ANALYSIS AND PRESENTATION OF FINDINGS

4.1 INTRODUCTION

This chapter outlines the results derived from the analysis of the study data. Employing a thematic analysis approach, the collected data was examined, delving into the obtained results and their relevance to the research inquiries. The study aimed to examine the role of vendors in addressing the challenges of data management systems in improving data-driven organisational processes. Its goal was to explore how vendors develop data management systems to address cybersecurity vulnerabilities, infrastructure scalability, interoperability, and non standardised data formats that inhibit data-driven organisational processes. This chapter presents the thematic analysis findings of the study.

4.2 DEMOGRAPHIC DETAILS OF THE FIELD STUDY

The following is a discussion of the demographic details of the study participants.

4.2.1 ORGANISATIONAL PROFILE

Health System Technologies (HST), established 24 years ago in 1999, is a cornerstone in the field of healthcare enterprise solutions in Africa. During this period, HST has successfully implemented and supported more than 388 ICT solutions, fostering the delivery of precise data precisely when needed, thus ensuring optimal outcomes. With a core mission to empower healthcare providers, HST operates on the principle of systematically improving healthcare service delivery in all care settings. The organization specializes in the development and provision of integrated health information systems, revolutionizing healthcare operations by introducing patient-/client-centric administrative and clinical systems. Through the implementation of electronic medical records, HST aims to reduce the reliance on paper records and establish seamless interoperability with various clinical support systems. HST's expertise spans a comprehensive range of services, covering everything from enterprise architecture and project management to integration and support. Their commitment to sustainability is evident through continuous client support and the ongoing evolution of systems, translating into exceptional returns on investment for their clientele.

4.2.2 DESCRIPTION OF DIFFERENT PARTICIPANTS

This research ascertained the demographic details of participants in relation to years of experience within the organization across different levels and positions, particularly

focusing on management and nonmanagement roles in the context of a research topic related to the role of vendors in addressing challenges in data management systems for enhancing data-driven organizational processes.

LEVEL	POSITION	YEARS WITHIN THE ORGANISATION
Management	Chief Operating Officer	23
Management	IT Operations Manager	15
Management	Product Development Manager	14
Management	Software Development Manager	11
Non-Management	Integration Developer	7
Non-Management	Product Owner	15
Non-Management	IT Specialist	14
Non-Management	IT intern	2
Non-Management	IT Support	3
Non-Management	IT Support	3

4.2.3 AGE OF PARTICIPANTS

The study obtained the age of the participants, and the breakdown is indicated in the table below.

Table 4.1 Age group

Age	Number
18-35years	5
36-45 years	3
Above 45 years	2

The findings indicate that all age groups were represented. Variable age groups could imply a diversity of perspectives on data management challenges. Younger participants (18-35 years) might bring fresh insights and possibly more attuned to newer technologies and trends. Meanwhile, older participants (over 45 years) may offer experience-based viewpoints, understanding historical contexts and traditional methods that might still hold relevance.

4.2.4 PROFESSIONAL QUALIFICATION

The table below shows the results of the professional qualifications of the participants.

Table 4.2 Professional qualification

Qualification	Number
Diploma and below	4
Bachelor's Degree	5
Post-Graduate and beyond	1

Table 4.2 presents the study findings in relation to the qualifications of the participants. The distribution suggests a mix of participants at different educational levels. This diversity could imply a range of perspectives, experiences, and levels of expertise in data management and organisational processes. The smaller number of participants with post-graduate qualifications might suggest a narrower pool of individuals with advanced knowledge in this specific domain. They could potentially offer deeper insights or specialized expertise in addressing complex challenges.

4.2.5 POSITION

The position of the participant is shown in the table below.

Table 4.3 Position

Position	Tick
Management	4
Non-management	6

There was an almost equal distribution of the management and nonmanagement of participants. This implies that there will be diverse points of view from the participants.

4.3 DATA ANALYSIS PROCESS

The study on vendor strategies in data management systems required a rigorous methodological approach to unveil their efficacy in addressing organisational challenges. A systematic thematic analysis approach, inspired by Braun and Clarke's (2006) method was used to dissect the data and identify recurring patterns pertinent to the role of vendors in enhancing data-driven processes. The initial steps involved coding transcripts and interviews documents to isolate instances of vendor-driven solutions within data management systems. These codes were crucial in steering the research

objectives and guiding the identification of prominent themes embedded in the data.

The analytical process embraced the hermeneutic cycle, involving an immersive interpretation of textual data and iterative analysis (see Appendix D). The recursive nature of this approach facilitated the extraction and consolidation of meaningful codes, maintaining an objective stance throughout successive iterations. As the analysis progressed, these codes were amalgamated into broader categories, forming potential themes. Similar codes were clustered together, triggering a re-evaluation of the data to unveil overarching themes and their interconnections, shaping the narrative of the study (see Appendix D).

An essential phase involved a meticulous scrutiny of potential themes to assess their relevance, alignment with textual data, and quality. Iterative review cycles led to the crystallization of interconnected themes, some aligning with established frameworks such as DeLone and McLean's IS success model. After iterations and robust themes evaluations, five primary themes emerged and were categorized. While anchored in the research questions, the approach remained inductive, empowering the researcher to dissect each theme along with its associated subthemes.

This comprehensive methodological framework facilitated a thorough exploration of vendor strategies within data management systems, shedding light on their significant role in mitigating challenges and amplifying data-driven organisational processes.

4.4 PRESENTATION OF FINDINGS

4.4.1 OBJECTIVE ONE: TO INVESTIGATE HOW VENDORS ADDRESS DATA MANAGEMENT SYSTEM QUALITY TO ENSURE SCALABILITY IN ORGANISATIONS.

This theme focuses on how vendors address the quality of data management systems to ensure scalability in organisations. The 8 out of 10 participants confirmed that scalability involves both horizontal scalability (increasing capacity by adding more hardware or nodes) and vertical scalability (enhancing capacity by improving existing resources). The theme focuses on distributing incoming data or queries evenly across multiple servers or nodes to prevent overload on any single resource. It also looks at load balancing that ensures that resources are utilised optimally.

4.4.1.1 ROBUST INFRASTRUCTURE

Most of the participants (8 out of 10) in this study reported that their organisation used robust infrastructure to ensure scalability. These participants highlighted that robust infrastructure is critical for scalability, encompassing resilient hardware, networks, and systems designed to handle data management efficiently. Vendors prioritize scalability by integrating redundancy measures such as backups and fail-safes and implementing technologies like load balancing to optimize data distribution and workload management across servers.

It was found that the essence of a robust infrastructure is paramount. This sentiment resonates with a participant who underscores the importance of investing in scalable hardware and redundant systems. His emphasis on load balancing and fail-safes highlights the need to distribute loads evenly and ensure continuous service accessibility even during surges. In particular, the participant said:

> *'At our organization Health System Technologies (HST), we prioritize the scalability and adaptability of our data management systems to handle data growth as workload demands increase. We employ robust infrastructure and utilize technologies that allow horizontal scaling, ensuring that our systems can handle increased data volumes without compromising performance." (Participant 2)*
>
> In support of the above, participant 3 stresses the importance of uninterrupted access to critical data. The participant mentioned that scalability is vital, enabling seamless handling of increasing transaction volumes without compromising speed or accuracy.

One of the participants argued that a robust infrastructure is imperative to ensure scalability in the health sector. Their focus on scalability aligns with the growing demands for healthcare data. Redundancy serves as a shield against potential downtime, ensuring continuous access to patient records and critical systems, thus prioritizing accessibility and security.

> *"A robust infrastructure isn't just a choice; it is a necessity. Scalability is prioritized to meet the growing demands for healthcare data. Redundancy is our shield*

against any potential downtime. It is about ensuring patient records and critical systems are always accessible and secure." (Participant 10)

The importance of a robust infrastructure for scalability emerged as a unanimous point of view among the study participants. Their collective emphasis on resilient hardware, redundant systems, and scalable technologies underscores its pivotal role in managing increasing data volumes and transaction demands. The sentiments expressed by various participants highlighted the need rather than preference for robust infrastructure in the healthcare sector where uninterrupted access to critical data is imperative.

The investment in scalable hardware, load balancing techniques, and redundancy measures reflects a strategic approach to ensure continuous service accessibility, security, and consistent user experience, even during surges in workload or traffic. This is supported by the literature, which argues that solid infrastructure and sensible resource allocation are required to scale up or down depending on demand (Singh et al., 2022). Vendors set up monitoring tools to continuously track system performance metrics. Automated scaling mechanisms then kick in based on predefined thresholds to allocate additional resources or scale down when the load decreases, ensuring optimal performance.

4.4.1.2 ROBUST ARCHITECTURE

Most of the participants (7 out of 10) in this study reported that their organisation used robust infrastructure to ensure scalability. In data management, a robust architecture would involve a well-designed database schema, efficient data storage mechanisms, and scalable algorithms to process data.

The participants highlighted that vendors ensure scalability by designing systems that can handle increased loads, implementing sharding (dividing a database into smaller, more manageable parts), employing caching mechanisms for faster access to frequently used data, and using distributed computing techniques. These participants are of the view that to ensure scalability in our data management systems at Health Systems Technologies (HST), we prioritize robust architecture, employing various techniques that bolster our infrastructure to accommodate escalating data demands effectively.

Participant 9 argued that: *"To ensure scalability in our data management systems at* Health Systems Technologies (HST)*, we prioritize robust architecture,*

employing various techniques that bolster our infrastructure to accommodate escalating data demands effectively".

This is in line with Participant 7 who argued that:

'Robust architecture in our context refers to the design and implementation of a resilient framework that can seamlessly adapt to increasing data volumes and workload demands. It involves creating a solid foundation built on scalable components and methodologies."

This shows that architecture forms the backbone of data management systems, enabling organisations to meet the evolving needs of health research initiatives while maintaining optimal performance and reliability.
In support of the above, participant 2 argued that: *"Our organisation tackles scalability by designing systems with adaptable architectures. We incorporate flexible frameworks that can be easily expanded, ensuring seamless handling of increased workloads."*

This participant went on to say that one key aspect of our robust architecture involves the use of distributed databases. These databases are designed to store and manage data across multiple nodes, ensuring that as our data grow, we can distribute the load efficiently without compromising speed or reliability. Thus, by distributing data across various nodes, we mitigate the risk of bottlenecks and system overload, allowing our research teams to access and analyse information swiftly and securely."

Therefore, the discussion shows that robust architecture within data management systems highlights a unanimous focus on creating resilient frameworks that can adapt seamlessly to escalating data demands. It encompasses the design and implementation of scalable components, employing techniques such as sharding, caching mechanisms, and distributed databases. The participants emphasized the importance of adaptable architectures that can handle increased workloads while maintaining optimal performance and reliability.

Techniques such as data partitioning and horizontal scaling were identified as key strategies to effectively manage growing data volumes. This can be supported by O'Neal (2012) who argued that data management comprises all disciplines related to data management, including creating and implementing architectures, policies, practices, and

procedures for managing the entire data life cycle. There is a need to design data structures and algorithms that are efficient and performant, especially when dealing with large datasets. This optimization is crucial to minimize processing times and resource utilization.

4.4.1.3 CITRIX

There were 8 out of 10 participants who said that Citrix solutions can aid in scalability by providing virtualized environments where applications and data can be centrally managed and accessed from various devices and locations. Participants highlighted that this could enhance scalability by allowing flexible resource allocation and efficient data access regardless of the device or location. Participant 2 said that our architecture is built on distributed processing, forming the backbone that segments tasks across nodes to prevent heavy computational tasks from hindering system performance.

This approach is complemented by our distributed database system, employing sharding and replication techniques for seamless scalability, effectively managing data growth without compromising speed or reliability. Scalability is further ingrained through micro-services architecture, allowing modularization for independent scaling of processing components, optimizing overall efficiency.

Participant 5 added that:

> *"Multiple different things are used for this. Citrix is used to boot up multiple instances of our applications which then get provided to users via a load balancer. We also split our system into multiple parts so things that take a lot of processing power do not affect our main system like when big reports are run".*

In support of the above, participant 2 said that distributed processing forms the backbone of our architecture, allowing us to segment tasks across multiple nodes. This approach ensures that heavy computational tasks, such as running extensive analyses on large datasets, do not impede the overall performance of the system.

> *'Our architecture revolves around a distributed database system, enabling seamless scalability. By employing sharding and replication techniques, we can effectively manage data growth and accommodate increasing workload demands without compromising speed or reliability."* (Participant 9)

Scalability is embedded in our infrastructure using microservice architecture. This setup allows us to modularize different functionalities, ensuring that specific components dealing with heavy processing can scale independently, optimizing overall system efficiency.

> *'We have adopted a containerization strategy using Kubernetes, allowing us to dynamically scale resources based on workload requirements. This flexibility ensures that our data management systems remain responsive and adaptable to fluctuating demands."* (Participant 6)

Therefore, it is safe to conclude that Citrix solutions play a pivotal role by enabling virtualized environments that centralize data and application access across diverse devices and locations. This centralized management improves scalability by facilitating flexible resource allocation and efficient data access, regardless of device or location restrictions.

4.4.1.4 CLOUD-BASED SERVER STORAGE PLATFORM

The majority (7 out of 10) participants highlighted that cloud-based server storage platforms offer scalable storage and computing resources on demand. Vendors leverage these platforms to ensure scalability by utilizing elastic storage options that can quickly adapt to changing data storage needs. They can scale storage capacity up or down as required, leverage autoscaling features for computing resources, and utilize distributed databases or object storage systems available in these platforms for efficient data management.

Participant 3 argued that: *"Cloud-based server storage platform with ability to increase data capacity".*

Scalability in data management was highlighted as crucial, especially in a health research organisation, where data volumes tend to grow rapidly. Implementing a robust architecture is critical to ensure that our systems can handle this expansion. One of the cornerstones of our approach involves leveraging a cloud-based server storage platform. This platform offers the inherent flexibility to seamlessly increase data capacity, aligning with the demands of our workload.

> *"To fortify this architecture for scalability, we implement several key strategies that bolster our data management systems. Employing a distributed file system allows for seamless scaling by adding more storage nodes as needed, ensuring*

uninterrupted data access and storage even as our datasets expand. " (Participant 5)

Furthermore, participant 8 argued that they prioritize the utilization of redundant storage techniques to maintain data integrity and accessibility.

"Our Cloud-Based Server Storage Platform offers a dynamic and flexible infrastructure designed to seamlessly accommodate expanding data requirements. With the ability to augment data capacity on demand, our platform ensures that businesses can scale their storage needs efficiently and without disruption." (Participant 9)

'At the core of our development philosophy lies a relentless commitment to scalability. Leveraging scalable databases and cloud solutions, we guarantee a smooth and unhindered expansion process. Our infrastructure empowers businesses to grow without worrying about performance constraints, as our systems are optimized to handle increased data loads effortlessly. ' (Participant 2)

'To stay ahead of data growth trends, we implement predictive analytics methodologies. By analysing historical data patterns, we proactively anticipate future growth, enabling us to fine-tune our systems for seamless scalability. This proactive approach minimizes potential bottlenecks, ensuring consistent and reliable performance even during periods of rapid expansion". (Participant 5)

The results of the discussion above show that a cloud-based server storage platform is essential to accommodate the scalable data needs of healthcare.

The platform offers inherent flexibility, enabling seamless augmentation of data capacity in response to growing datasets. Strategies such as implementing distributed file systems, redundant storage techniques, dynamic load balancing, and predictive analytics methodologies ensure uninterrupted data access, high availability, and optimized system performance. When designing a data management system using a cloud-based server storage platform, it is crucial to consider factors like data security, compliance requirements, performance optimization, and vendor lock-in (Gopal et al., 2019).

Table 4.4: Summary of the Findings linked to Objective one

Objective One	Themes	Findings
To investigate how vendors address data management system quality to ensure scalability in organisations.	Robust Infrastructure	1. Robust infrastructure encompasses resilient hardware, networks, and systems designed to handle data management efficiently. 2. Vendors prioritize scalability by integrating redundancy measures such as backups and fail-safes, as well as technologies such as load balancing to optimize data distribution and workload across servers. 3. Vendors make use of technologies like load balancing to optimize data distribution and workload across servers.
	Robust Architecture	1. Vendors ensure scalability by designing systems that can handle increased loads, implementing sharding (dividing a database into smaller, more manageable parts) 2. Vendors employ caching mechanisms to have faster access to frequently used data and using distributed computing techniques.
	Citrix	1. Scalability is enhanced through a microservices architecture, allowing for modularization and independent scaling of processing components. 2. The architecture is built on distributed processing, which segmented tasks between nodes to prevent heavy computational tasks from hindering system performance.
	Cloud-based server storage platforms	1. Vendors utilize distributed databases and object storage systems available within these cloud platforms for efficient data management. 2. Cloud-based server storage platforms

		scale storage capacity up or down as required, leverage auto-scaling features for computing resources, and utilize distributed databases or object storage systems available in these platforms for efficient data management.

4.4.2 OBJECTIVE TWO: TO DETERMINE THE TECHNICAL REQUIREMENTS FOR INTEROPERABILITY WHEN IMPLEMENTING DATA MANAGEMENT SYSTEMS IN ORGANISATIONS

This theme embarks on an exploration of the critical aspects of data management systems and their interoperability. It aims to dive into the technical prerequisites, standards, security protocols, and integration capabilities crucial to ensuring efficient data exchange while protecting against potential vulnerabilities. In today's interconnected digital landscape, effective data management systems serve as the backbone of organizational operations, enabling seamless data flow, accessibility, and utilization across various platforms and applications. However, achieving interoperability among these systems is a multifaceted challenge that demands a comprehensive understanding of technical requirements, adherence to robust standards, and stringent security measures.

4.4.2.1 STANDARDS OR PROTOCOLS

Most of the participants (7 out of 10) in this study expressed the view that the dynamic landscape of data management systems, standards, and protocols serves as the foundational pillars dictating data organization, processing, and transmission. Most of the participants view these guidelines as like a universal language that bridges the gap between heterogeneous systems, ensuring seamless communication and interaction. Whether it is the widely embraced XML and JSON formats or specialized industry protocols tailored to specific domains, their primary function is to harmonize data interpretation and processing across a multitude of applications and databases. In particular, the following was said by participant 2:

> *'When designing our data management systems, we adhere to industry standards and protocols such as HL7, DICOM, FHIR, and HIPAA. These standards ensure interoperability, data integrity, and compliance with privacy and security*

regulations. By following these protocols, we ensure that our systems can seamlessly integrate with other healthcare systems and exchange data securely.

Participant 3 added that:

"HL7 Clinical Document Architecture and FHIR Standards to ensure data can be shared across applications. We need to verify that our database model has correctly defined tables and relationships and are correctly indexed. When it comes to sending data to other third parties, we need to make sure that it conforms to the HL7 international standard messaging protocol for sending patient data, as well as for data to be available via a SOAP web service."

"In healthcare, our considerations revolve around electronic health record (EHR) systems, clinical data warehouses, and data analytics platforms. These technologies allow for seamless data sharing among practitioners, enhancing evidence-based treatment, and enabling predictive analytics. However, challenges in data privacy, security, and interoperability remain significant." (Participant 5)

The participants highlight the critical role of standards and protocols in various industries, particularly healthcare. These conclusions underscore the need to adhere to established protocols such as HL7, DICOM, FHIR, HIPAA, HER, and API. HL7 is a set of international standards for the transfer of clinical and administrative data between software applications used by various healthcare providers. It focuses on the exchange, integration, sharing, and retrieval of electronic health information. DICOM is a standard for handling, storing, printing, and transmitting medical imaging information. It ensures the interoperability of systems used to produce, store, display, process, send, and retrieve medical images.

FHIR is a standard for electronically transferring health information. It uses modern web standards like RESTful APIs (Representational State Transfer) to enable interoperability between different healthcare systems, allowing for easier sharing of healthcare data (Gopal et al., 2019). Electronic health record (EHR) systems, clinical data warehouses, and data analytics platforms are widely adopted. These technologies provide seamless data sharing among healthcare practitioners, improve evidence-based treatment, and enable predictive analytics for disease prevention and patient outcomes (Singh et al., 2022).

4.4.2.2 ENSURING SECURE DATA EXCHANGE

Most of the participants (8 out of 10) highlighted that within the intricate tapestry of data exchange, the security subplot takes centre stage. Vendors navigating this realm embark on a quest to fortify their data exchange mechanisms against the lurking threats of unauthorized access and breaches. Encryption emerges as a shield, cloaking sensitive information in layers of cryptographic armour. Secure transmission protocols, exemplified by the stalwarts SSL/TLS, stand as sentinels guarding the pathways through which data traverse. Access control mechanisms act as gatekeepers, rigorously vetting entrants seeking entry to the data sanctum. Participants had the following to say:

> *"Our data management systems implement stringent security measures such as encryption, access controls, and compliance with industry standards such as HIPAA in healthcare. However, despite these measures, challenges persist in ensuring secure data exchange due to the sensitivity of clinical data and the complex patient matching algorithms." (Participant 3)*

> *"Our systems incorporate encryption, access controls, and compliance with industry standards such as HIPAA to ensure secure data exchange. However, challenges persist due to the sensitive nature of clinical data, complex patient matching algorithms, and the need for stringent adherence to ethical policies and governing rules, posing obstacles in achieving seamless security measures." (Participant 8)*

> *"Data security is of utmost importance to us. Our data management systems employ various security measures to ensure secure data exchange between systems and prevent data breaches. These measures include encryption techniques, access controls, user authentication, and regular security audits. We prioritize the confidentiality, integrity, and availability of data to maintain a secure environment for our clients" (Participant 10)*

This shows that the art of data masking paints a disguise over critical data elements, ensuring their concealment even within trusted environments. Compliance with regulatory frameworks such as GDPR or HIPAA adds a regulatory sheen, accentuating the need for vendors to navigate the labyrinth of laws while maintaining the sanctity of

data. The evaluation of vendors' deployment and emphasis on these security fortifications becomes the cornerstone in the saga of ensuring the confidentiality, integrity, and accessibility of data, especially in the orchestration of data-centric organizational operations.

According to Jennex et al. (2022), there is the ability to combine several data sources into a single cohesive system. This benefit enables businesses to eliminate data silos and to have a comprehensive understanding of their information assets. HIPAA provides effective data exchange, improved data consistency, and thorough data analysis and integration. The integration strategy fosters cooperation, improves decision-making procedures, and enables data-driven insights across organizational divisions (Jabbar et al., 2020).

4.4.2.3 INTEGRATE WITH OTHER THIRD-PARTY APPLICATIONS

The findings of the study show that there were 8 participants who mentioned that in the symphony of modern data management, the interoperability melody orchestrates harmony among disparate systems. Vendors take on the role of maestros, conducting the integration of their solutions with various third-party applications. The conduit for this synergy often emerges in the form of APIs, acting as bridges that seamlessly connect varied systems and applications. Middleware solutions and pre-built connectors also play instrumental roles, serving as enablers in the symphonic fusion of data exchange across ecosystems.

> *"Yes, our data management systems are designed to integrate with other third-party applications. We provide well-documented APIs and support industry-standard integration methods such as RESTful APIs and message queues. This allows seamless data exchange and interoperability with other healthcare applications, enabling our clients to leverage the benefits of a connected ecosystem. " (Participant 5)*

> *"Yes, our data management systems are designed to integrate with third-party applications by adopting standardized data formats such as IMS Global Learning Consortium's LIS or xAPI. Furthermore, the use of APIs facilitates smooth integration, enabling secure and efficient data transfer." (Participant 7)*

"Yes, our data management systems are designed to integrate with other third-party applications. We achieve this using standardized application programming interfaces (APIs) and interoperability frameworks. These enable seamless data exchange and integration with other healthcare systems and applications." (Participant 3)

The scrutiny and analysis of the effectiveness and seamlessness of these integration mechanisms offered by vendors emerge as critical notes in the composition of an organization's data landscape.

The ease with which these connections are forged dictates the organization's capacity to leverage the diverse array of applications within its data ecosystem, ultimately fine-tuning operational efficiency and fortifying the bedrock upon which informed decision-making processes stand (Jennex et al., 2022).

Table 4.5: Summary of the findings linked to objective two.

Objective two	Themes	Findings
To determine the technical requirements for interoperability when implementing data management systems in organisations.	Standards or protocols	1. Standards or protocols are akin to a universal language that bridges the gap between heterogeneous systems, ensuring seamless communication and interaction. 2. A crucial technical requirement for ensuring interoperability would be to prioritize systems and solutions that support these widely embraced formats or industry-specific protocols.
	Ensuring secure data exchange	1. When implementing data management systems, organizations must prioritize interoperability by adopting widely accepted and secure transmission protocols. 2. A technical requirement could involve specifying standardized access control protocols or methods to ensure that various systems within the organization

		can effectively regulate and manage access to data.
	Integrate with other third-party applications	1. Vendors step into the role of maestros, conducting the integration of their solutions with diverse third-party applications. 2. Middleware solutions and pre-built connectors also play instrumental roles, serving as enablers in the symphonic fusion of data exchange across. 3. Vendors might use pre-built connectors, which also play instrumental roles, serving as enablers in the symphonic fusion of data exchange across ecosystems.

4.4.3 OBJECTIVE 3: TO ASSESS THE NET BENEFITS OF DATA MANAGEMENT SYSTEMS

Many of the participants highlighted that the net benefits attributed to data management systems contribute significantly to organizational productivity and cost reduction. Vendors play a pivotal role in facilitating these benefits by providing solutions that streamline processes, enhance accessibility, and optimize data handling mechanisms, enabling organizations to thrive in data-driven landscapes while simultaneously economizing resources and bolstering operational efficiency.

4.4.3.1 ORGANIZATIONAL PRODUCTIVITY

The implementation of robust data management systems significantly improves organizational productivity as supported by 6 out of 10 participants in this study. By streamlining data access, storage, and analysis, these systems allow employees to quickly retrieve pertinent information, fostering informed decision making and expediting task completion. Vendors that contribute to such systems facilitate the integration of user-friendly interfaces and efficient data retrieval mechanisms, thereby enhancing the overall operational efficiency of the organization. This increased productivity is evident in accelerated project timelines, optimized resource allocation,

and increased agility in responding to market demands.

"Yes, as we can schedule daily tasks/processes to automate calculations, activities, and reporting on our data, which we can monitor on an ad hoc or daily measure." (Participant 1)

This was supported by Participant 2 who had this to say:

"Absolutely, we have stringent measures in place to monitor the productivity bolstered by our DMS. We track the accuracy, consistency, and reliability of the data as key indicators. It involves validating data through automated processes, ensuring clean and consistent information for confident decision making. " (Participant 2)

"Our system employs real-time data access and validation techniques. We constantly monitor operational data to quickly identify deviations and take corrective actions. It allows us to streamline workflows, automate tasks, and improve collaboration across teams, ultimately enhancing productivity." (Participant 5)

The use of management portals, reports, and dashboards for monitoring aligns with the best practice of using visualization tools to present data insights effectively. Visual representations help stakeholders understand complex data and make informed decisions. The literature shows that by utilizing these tools, organizations can effectively assess their performance, identify areas for improvement, and use data to make informed decisions about resource allocation (Matheus et al., 2020). Therefore, organisations are empowered to optimize their operations, improve productivity, and achieve goals with greater precision and efficiency.

4.4.3.2 REDUCE COSTS

A substantial number of participants (7 out of 10) said that data management systems have a substantial influence on cost reduction within organisations. Vendors specializing in these systems offer solutions that streamline data storage, minimize redundancies, and optimize data processing methodologies.

Consequently, this streamlined approach mitigates the expenses associated with excessive data storage, eliminates redundancies, and eliminates the need for extensive

manual data handling. The resulting cost savings span various aspects of operations, including reduced infrastructure costs, reduced error rectification expenses, and lower labour overhead. Such savings not only contribute directly to the bottom line, but also allow redirected resources toward innovation and strategic initiatives. In this regard, participant 3 had to say:

> *"Certainly, our DMS has contributed significantly to cost reduction. By automating tasks and streamlining workflows, we have cut down operational expenses. Moreover, its ability to provide real-time data access has improved our decision-making, optimized resource allocation, and minimizing unnecessary costs."(Participant 3)*
>
> *"Our DMS plays a crucial role in cost reduction. It simplifies data management, ensuring data accuracy and reliability, preventing costly errors. Additionally, the system's efficiency in facilitating strategic decision-making helps in optimizing resources and minimizing unnecessary expenditures. " (Participant 5)*
>
> *"Absolutely, our DMS has been instrumental in reducing organizational costs. Its role in enhancing operational efficiency through automation and improved collaboration has directly resulted in cost savings. Additionally, using data insights for strategic decisions has optimized our expenditures. (Participant 6)*

The responses of various participants underscore a unanimous agreement on the pivotal role data management systems (DMS) play in cost reduction within organizations. They highlight the multifaceted impact of DMS, highlighting key elements such as automation, improved data accuracy, streamlined operations, enhanced decision-making, and optimized resource allocation. Through these systems, organizations experience a significant decrease in operational expenses, reduced manual intervention, minimized errors, and better utilization of resources. The efficiency gains and strategic insights obtained from DMS not only directly impact the bottom line, but also enable the redirection of resources toward innovation and strategic initiatives. The literature shows that although cyber insurance plans can cover the direct financial costs of a breach in some instances, reputational damage can be long-lasting, difficult to quantify, and repair (Lis & Mendel, 2019).

Table 4.6: Summary of the findings linked to objective three.

Objective three	Themes	Findings
To assess the net benefits of data management systems	Organizational productivity	1. Data management systems streamline data access, storage, and analysis. 2. Data management systems enable employees to quickly retrieve pertinent information, fostering informed decision-making, and accelerating task completion. 3. Vendors that contribute to such systems facilitate the integration of user-friendly interfaces and efficient data retrieval mechanisms, thereby enhancing the overall operational efficiency of the organization.
	Reduce costs	1. Data management systems streamlined approach mitigates the expenses associated with excessive data storage. 2. Data management systems help eliminate redundancies and reduce the need for extensive manual data handling. 3. Data management systems that include reduced infrastructure costs, minimized error rectification expenses, and reduced labor overhead.

4.4.4 OBJECTIVE FOUR: TO IDENTIFY HOW VENDORS CAN LEVERAGE DATA MANAGEMENT SYSTEMS TO IMPROVE THE EFFICIENCY AND EFFECTIVENESS OF DATA-DRIVEN ORGANISATIONAL PROCESSES

4.4.4.1 CURRENT CHALLENGES

A substantial number of participants (9 out of 10) show that the landscape of data management is a dynamic terrain marked by a series of complex challenges. From grappling with erratic data load patterns and maintaining consistency across diverse applications to navigating the intricacies of cloud migration, each hurdle demands nuanced solutions. The quest for efficiency in handling voluminous files while

safeguarding data privacy in an increasingly digitized world adds layers of complexity. In the realm of healthcare, ensuring data quality and integrity, fortifying security measures amidst rapid evolution, and grappling with the complexity of standards are ongoing battles.

These challenges require an ongoing commitment to research, collaboration with industry leaders, and an unwavering pulse on technological advancements.

> *'Our struggle lies in efficiently managing irregular data load patterns, particularly facing bottlenecks during peak periods. Balancing the ebb and flow of data influx remains a significant challenge.' (Participant 9)*

> *'One of our persistent challenges is maintaining data consistency between diverse applications, each with distinct requirements. Achieving uniformity while meeting varied demands remains an ongoing hurdle." (Participant 2)*

> *'The migration to the cloud infrastructure has introduced additional complexities. Integrating our data management solutions within this environment poses continuous challenges that demand streamlined solutions." (Participant 5)*

The challenges highlighted by Pandit and Agrawal (2022) and Patel et al. (2016) regarding cloud computing, cloud apps, and the irregular nature of data load can have significant repercussions on the functionality of data management systems (DMS) in organisations. Managing irregular data load adds complexity to system architecture, necessitating the implementation of sophisticated load-balancing mechanisms, dynamic resource allocation algorithms, and intelligent data management strategies. This complexity requires expertise, specialized skills, and additional resources, which poses challenges for organisations.

4.4.4.2 AREAS OF IMPROVEMENT

Participants highlighted that amidst the evolving landscape of data management, the imperative for vendors to adapt their solutions to handle fluctuating data loads, ensure consistent data across varied applications, and seamlessly integrate within cloud environments has become paramount. Additionally, the demand for efficient manipulation of large-scale data and robust privacy measures underscores the need for innovative approaches. To address these challenges, participants had the following to say:

'Vendors should prioritize developing solutions capable of seamlessly managing irregular data load patterns. The ability to dynamically adjust to varying data volumes is crucial." (Participant 5)

'Improvements in ensuring consistent data between different applications are imperative. Vendors should focus on flexible solutions that accommodate diverse data consistency needs. ' (Participant 2)

'Enhanced integration capabilities during cloud migration are essential. Solutions that offer seamless data management within cloud environments will alleviate integration complexities. ' (Participant 4)

The participants collectively underscored the urgent need for vendors to re-design their solutions in response to the evolving data landscape. Key priorities include the development of adaptable systems capable of managing fluctuating data loads, ensuring consistent data across diverse applications, seamless integration within cloud environments, efficient manipulation of large-scale data, and robust privacy measures. Bolton et al. (2018) highlight that organizations use data management systems to discern patterns in both customer engagement and operational efficiency. These systems enable areas that need improvement to be identified, facilitating streamlined business operations.

In addition, they help to create precise forecasts and models, giving a competitive edge. In the realm of digital health, electronic health records (EHRs) serve as a key component. They are part of the intricate infrastructure of technology utilized to store, analyse, and distribute information, thus enhancing quality-of-service delivery. However, it is crucial to note that the effectiveness of health information retrieved through IT systems is contingent upon the quality of data added at the system's inception (Blizinsky & Bonham, 2018).

4.4.4.3 KEEPING UP WITH THE EVOLVING TECHNOLOGIES AND DATA MANAGEMENT TRENDS

The 8 out of 10 participants highlight their commitment to staying at the forefront of technology. They suggest the need to invest in research and development, actively monitor industry trends, engage in partnerships, and prioritize the upskilling of their teams. The incorporation of emerging technologies such as AI, machine learning, and cloud computing into their data management systems reflects their commitment to

innovation and adaptability. Ultimately, their goal is to meet the evolving needs of their clients and the industry. In particular, the participants had the following to say:

> *'Vendors should prioritize developing solutions capable of seamlessly managing irregular data'. 'Exploring AI-powered solutions to automate data analysis is on our radar. Personalized insights derived from automated processes are expected to enhance decision-making capabilities. ' (Participant 1)*
>
> *'Considering blockchain technology for secure storage and verification of records is part of our adaptation strategy. Exploring its potential to fortify data integrity is a key consideration. ' (Participant 3)*
>
> *'To stay up to date with evolving technologies and data management trends, we have a proactive approach. We invest in research and development to stay at the forefront of emerging technologies such as cloud computing, big data analytics, and artificial intelligence. We actively monitor industry trends, collaborate with technology partners, and engage in continuous learning to adapt our data management systems accordingly. This ensures that our systems remain innovative, scalable, and capable of meeting the evolving needs of our clients and the healthcare industry as a whole. ' (Participant 4)*

The participants unanimously stressed the imperative to adapt to evolving technologies and data management trends. Their consensus centres on several key strategies: investing in research and development, actively tracking industry advancements, fostering partnerships, prioritizing team upskilling, and integrating emerging technologies like AI, machine learning, and cloud computing into their data management systems. These approaches collectively underline their commitment to innovation, adaptability, and meeting the changing demands of their clientele and the industry.

Table 1.7: Summary of the findings linked to objective four.

Objective two	Themes	Findings
To identify how vendors can leverage data management systems to improve the efficiency and effectiveness of data-driven	Current challenges	1. Vendors grapple with erratic data load patterns and maintain consistency across diverse applications to navigate the intricacies of cloud migration, each hurdle demands nuanced solutions.

organizational processes		2. The quest for efficiency in handling voluminous files while safeguarding data privacy in an increasingly digitized world adds layers of complexity.
	Arears of improvements	1. Adapt solutions to handle fluctuating data loads, ensure consistent data across varied applications. 2. The demand for efficient manipulation of large-scale data and robust privacy measures underscores the need for innovative approaches.
	Keeping up with evolving technologies and data management trends	1. There is a need to invest in research and development. 2. The organization can actively monitor industry trends, engage in partnerships, and prioritize upgrading their teams. 3. The incorporation of emerging technologies such as AI, machine learning, and cloud computing into their data management systems reflects their dedication to innovation and adaptability.

4.5 CONCLUSION TO CHAPTER FOUR

This chapter presented a detailed analysis of the study based on the data collected from the participants. Thematic analysis carried out on the data collected for this study has provided valuable information on the role of vendors in addressing the challenges of data management systems. The findings underscore the critical importance of vendor strategies in mitigating cybersecurity vulnerabilities, improving infrastructure scalability, addressing interoperability issues, and standardizing data formats.

These elements are crucial in facilitating and improving data-driven organisational processes. The study's exploration of how vendors develop data management systems has shed light on the complexities involved and emphasized the need for comprehensive solutions that effectively navigate these challenges. Moving forward, it is evident that collaboration between vendors and organisations is essential to successfully harnessing the full potential of data-driven processes. The next chapter will be Chapter 5, where we delve into a comprehensive analysis of the findings and establish connections between these findings and the existing literature.

CHAPTER 5: DISCUSSION OF FINDINGS

5.1 INTRODUCTION

The focus of this chapter is to present the findings of the study. The aim of the study was to investigate and understand how vendors develop and implement data management systems to effectively address challenges related to cybersecurity vulnerabilities, infrastructure scalability, interoperability, and non-standardized data formats that impede data-driven organizational processes. In interpreting the findings of this study, the objective is to explore the relevance and implications of these findings through the lens of the IS success model. The integration of the DeLone and McLean Information Systems Success Model provides a structured framework to assess how vendors' approaches align with the identified challenges in data management systems. By aligning the findings with this model, it becomes possible to evaluate how vendor strategies contribute to system quality, information quality, user satisfaction, and, consequently, to the overall success of data-driven organizational processes.

5.2 INTERPRETATION OF FINDINGS USING IS SUCCESS MODEL

5.2.1 SUSPENSION OF QUALITY OF DATA MANAGEMENT SYSTEM

The findings related to system quality resonate strongly with the emphasis of the IS success model on technical aspects. The robust infrastructure and architecture highlighted by the participants align with the model definition of system quality, emphasizing reliability, scalability, and functionality. The responses of the participants demonstrated that the data management systems under study are reliable, as they consistently remain available and accessible when needed. These systems also employ technologies that enable horizontal scaling, ensuring their ability to handle larger data volumes without sacrificing performance. Data management system vendors offer various customized functions for the specific requirements of health systems, including data integration, analytics, and reporting capabilities. This enables organizations to make well-informed decisions based on accurate and timely information, thereby supporting their strategic and operational goals (Yebenes & Zorrilla, 2019).

Papagiannidis, Enholm, Dremel, Mikalef and Krogstie (2023) report that ensuring the quality of a data management system involves standardization in technology and infrastructure choices, particularly in the context of AI. This is important because there are various tools available for developing AI products. For example, an organization faced

compatibility issues due to legacy code written in different programming languages. To address this, it became necessary to unify and standardize the tools used. Additionally, a vendor was required to improve the speed and scalability of the model as the company dealt with larger data volumes and developed new intelligence based on those data. These changes resulted in improved efficiency, higher quality, and increased employee satisfaction through automation, which alleviated the burden of manual work. Overall, this means that prioritizing data management system quality can have significant benefits for the organization's operations and decision-making processes.

Most participants indicated that the quality dimension of the system of the IS model focuses on the technical aspects of the system itself, including its reliability, ease of use, flexibility, and performance (Purwati et al., 2021). Data management systems with high-quality design and functionalities tend to be more successful. This aligns with Hidayah et al. (2020), who emphasised the importance of robust infrastructure in ensuring the quality and scalability of data management systems. Thus, the findings confirm that vendors addressing scalability concerns through infrastructure that is robust align with the IS Success Model's concept of system quality.

5.2.2 RELEVANCE OF INFORMATION QUALITY TO DECISION MAKER

The discussions on standards, secure data exchange, and integration echo the importance of information quality. Within the IS model, information quality refers to the precision, relevance, completeness, and timeliness of the information provided by the system (Çelik and Ayaz, 2022). The relevance of information quality to decision making is highlighted by the need for vendors to ensure accuracy, relevance, completeness, and timeliness in data management systems. This requires the identification and tracking of each data element, including its origin, transformations, location, participation in tasks and processes, and alignment with strategic business objectives. To achieve shared decision-making and control through data governance, a monitoring process must be established to ensure the adherence to objectives, policies, and standards and to verify the proper execution of information management processes.

The quality of information is crucial for effective decision making. Data architecture plays an important role in this process by enabling companies to use internal data sharing and visualization. This allows decision makers to access relevant information and support their decision-making processes. Additionally, data architecture facilitates the provision

of pertinent information to external auditors. During this phase, companies also select the most suitable technologies, such as artificial intelligence and blockchain, as well as tools and methods to ensure automated and seamless data operation management (Liakh, 2021).

High-quality information supports better decision making and enhances the value of the system. The emphasis of participants on standards such as HL7 (Health Level Seven), DICOM (Digital Imaging and Communications in Medicine), FHIR (Fast Healthcare Interoperability Resources), and HIPAA (Health Insurance Portability and Accountability Act) correlates with the dimension of information quality of the IS Success Model, emphasizing correctness, relevance, and data security. Hidayah et al. (2020) supports this correlation by highlighting how adherence to standards and secure data exchange influence the reliability and relevance of information. Therefore, the findings validate that the focus of the vendors on standards and secure exchange directly contributes to information quality, essential for informed decision making.

Vendors play a crucial role in ensuring data accuracy by taking steps to reduce errors and inconsistencies, as well as implementing efficient data validation processes. To extract valuable insights from data management systems, organizations should invest in reliable data analytics tools and techniques. This investment will enhance their decision-making processes and enable them to make more informed choices (Nilashi, Abumalloh, Ahmadi, Samad, Alrizq, Abosaq & Alghamdi, 2023).

This has led to the general benefits of the data management system of increasing productivity and reducing costs, as discussed in the data findings. The service quality dimension of the IS model encompasses the support, assistance, and responsiveness provided by the people or service personnel associated with the information system. Good service quality contributes to user satisfaction and system effectiveness. Hidayah et al. (2020) have shown that service quality has a statistically significant effect on user satisfaction. In addition, both user satisfaction and behaviour intentions were found to have a significant impact on actual usage.

This is in line with another dimension of the IS success model of net benefits. This factor assesses the tangible and intangible benefits that the organization derives from the information system. IS a success model benefit according to Çelik and Ayaz (2022)

includes improvements in productivity, decision making, cost savings, and other positive outcomes.

5.2.3 USER SATISFACTION CONSIDERATIONS

The insights into user satisfaction, including the need for adaptable systems and seamless integration, align with the IS success model's dimension of user satisfaction. Participants' suggestions for improvements directly address user concerns regarding system adaptability and integration, which are key factors influencing user satisfaction. Yakubu and Dasuki (2018) affirm that user satisfaction is influenced by system adaptability and integration, indicating that vendors' efforts in these areas positively impact user satisfaction levels. User satisfaction reflects the feelings and attitudes of users towards the system. Satisfaction is influenced by several factors, including system performance, ease of use, and the extent to which it meets user expectations.

Nilashi et al. (2023) Client satisfaction is influenced by service quality, which in turn affects client retention. Additionally, studies have found that client satisfaction acts as a mediator between service quality and client commitment. This highlights the importance of establishing long-term relationships with clients and delivering high-quality services. Service quality in this context refers to clients' perception of their experience when receiving information services and the value they derive from those services. It encompasses their assessment of the process of receiving information services and the outcomes of those services. The level of support, assistance, and responsiveness provided to customers through the CRM system is a crucial aspect of service quality and contributes to the overall quality of information systems.

In the realm of improving data-driven organizational processes, vendors play a pivotal role in addressing the challenges intrinsic to data management systems. Vendors serve as key enablers not only by providing technological solutions, but also by understanding and aligning with the evolving needs of organizations. They must actively participate in developing adaptable systems and ensuring seamless integration to meet the complex demands of data management. Understanding user satisfaction, as highlighted by scholarly works like Yakubu and Dasuki (2018) and Nilashi et al. (2023), emphasizes the importance of vendors' efforts in enhancing system adaptability and integration. Such efforts directly impact user satisfaction, thus fostering a conducive environment for improved data-driven processes within organizations. By consistently refining and

innovating their offerings, vendors contribute significantly to elevating data management systems, ultimately empowering organizations to derive greater value and insights from their data assets.

5.3 ANSWERS TO RESEARCH SUB-QUESTIONS

5.3.1 How do vendors address the quality of the data management system to ensure scalability?

The findings of the participants shed light on various strategies adopted by vendors to ensure scalability in data management systems. The discussions revolved around robust infrastructure, robust architecture, and the utilization of cloud-based server storage platforms. Most of the participants emphasized the importance of robust infrastructure, which includes resilient hardware, redundant systems, and scalable technologies to handle increasing data volumes without compromising performance. This aligns with the objective of investigating how vendors ensure scalability, showcasing a unanimous focus on elements such as load balancing, redundancy measures, and horizontal scaling.

5.3.2 What are the technical requirements for interoperability when implementing data management systems?

The participants provided insights into the critical technical requirements for interoperability in data management systems. They highlighted the importance of adhering to standards or protocols such as HL7, DICOM, FHIR, and HIPAA, emphasizing their role in ensuring data integrity, secure data exchange, and compliance with industry regulations. Encryption, secure transmission protocols such as SSL/TLS and integration with third-party applications through APIs emerged as crucial technical aspects that facilitate seamless data exchange. The discussions clearly address the technical prerequisites essential for interoperability within data management systems.

5.3.3 What are the overall net benefits attributed to data management systems?

Most of the participants outlined significant net benefits associated with data management systems. They emphasized the pivotal role of these systems in improving organizational productivity and reducing costs. The discussions highlighted how these systems streamline data access, storage, and analysis, resulting in faster decision making, optimized resource allocation, and minimized operating expenses. By employing real-time data access, automation, and efficient data handling mechanisms, organizations

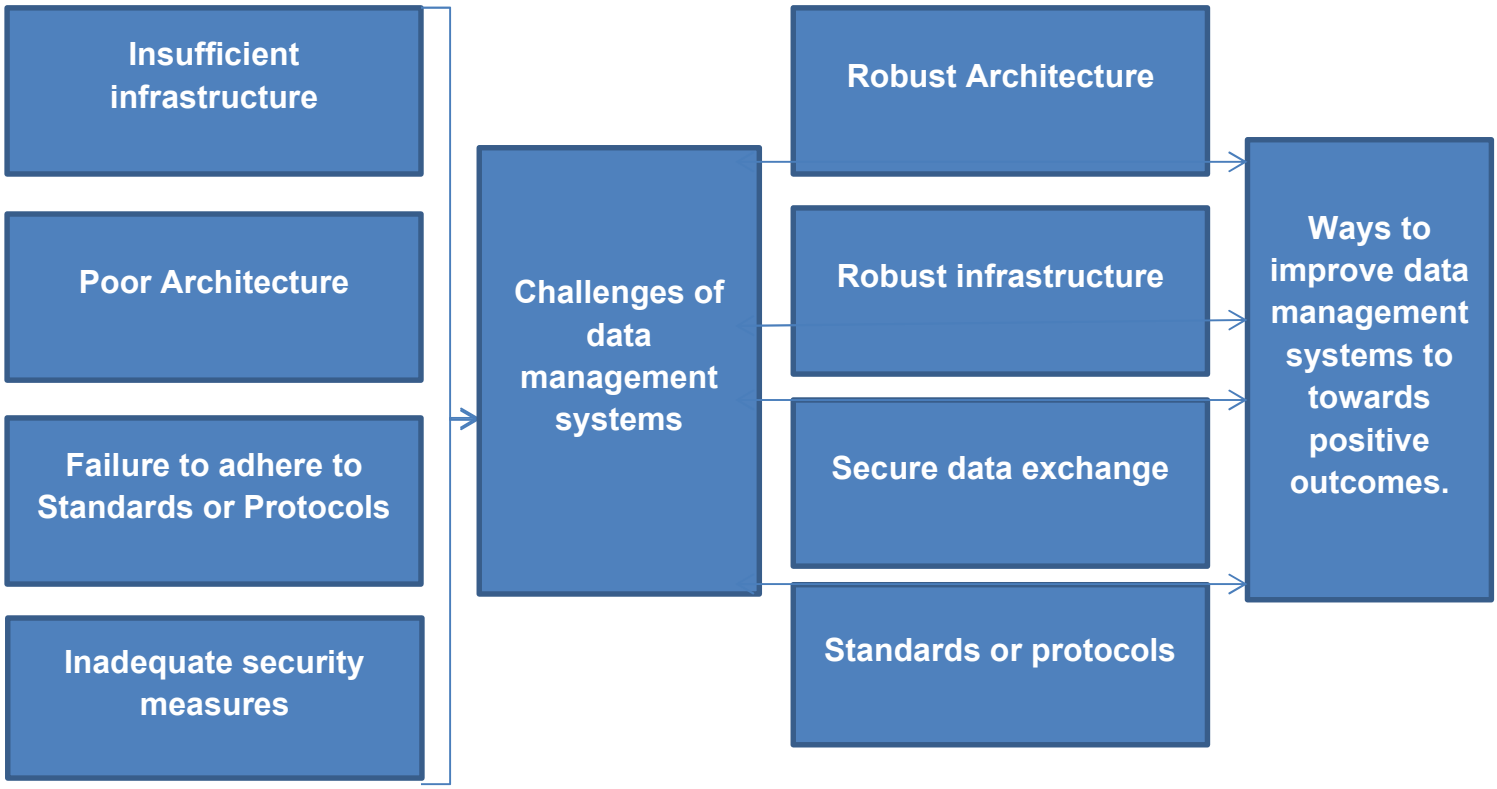
achieve increased productivity and substantial cost reductions, aligning with the objectives of assessing the net benefits of data management systems.

5.3.4 How can vendors improve data management systems to address the challenges of data-driven organizational processes?

The participants extensively discussed the current challenges facing vendors in managing data-driven organizational processes. Challenges included managing irregular data load patterns, maintaining data consistency across diverse applications, ensuring privacy, and navigating complexities during cloud migration. In response, participants emphasized areas of improvement, such as developing adaptable systems capable of handling fluctuating data loads, ensuring consistent data across applications, seamless integration within cloud environments, efficient data manipulation, and robust privacy measures. These discussions effectively address how vendors can enhance data management systems to overcome existing challenges.

The findings can be shown diagrammatically below:

Figure 4.1 Presentation of findings



5.4 CONCLUSION TO CHAPTER FIVE

Chapter 5's findings reveal a significant interplay between vendors' strategies and the challenges inherent in data management systems. Using the IS success model as a lens, this study illustrates how vendors' approaches directly influence critical facets like system quality, information quality, and user satisfaction. The conclusions highlight several key points: first, vendors addressing scalability concerns and bolstering infrastructure align with the IS Success Model's system quality, ensuring reliability and functionality. Second, efforts focused on standards, secure data exchange, and integration contribute to information quality, vital for informed decision-making. Third, addressing user concerns about adaptability and integration positively impacts satisfaction levels. Furthermore, these strategies directly confront identified challenges such as cybersecurity vulnerabilities and interoperability issues, improving organizational processes based on data. Additionally, these systems drive operational efficiency and cost reduction by streamlining processes and reducing associated expenses. The vendors are recommended to adapt solutions to fluctuating data loads, ensure consistency between applications, and invest in emerging technologies such as AI and cloud computing for continual improvement. The following is Chapter 6, which represents the culmination of this thesis. Within this chapter, the conclusions drawn from the research will be presented and provide valuable recommendations based on the findings.

CHAPTER 6: THESIS CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter concludes the study by briefly presenting the practical, theoretical, and methodological implications of the study, highlighting the limitations of the study, and offering recommendations for future research.

6.2 ADDRESSING THE RESEARCH AIM

How do data management systems vendors address the challenges that inhibit operational processes in organisations?

6.2.1 List of challenges

Insufficient infrastructure: challenges in ensuring scalable and resilient hardware, networks, and systems to handle increasing data volumes and workload demands.

Poor Architecture: Inefficient design of database schemas, storage mechanisms, and scalable algorithms to process data effectively.

Failure to adhere to standards or protocols: Non-adherence to industry standards like HL7, DICOM, FHIR, and HIPAA for data interoperability across systems.

Inadequate security measures: Implement encryption, access controls, and compliance measures such as HIPAA to ensure secure data transmission.

6.2.2 Nature of Challenges and Impact on DMS

Insufficient infrastructure-Insufficient infrastructure can lead to performance bottlenecks, affecting access to critical data. This can result in inconsistent information and hinder informed decision making. Additionally, without scalability, it becomes challenging to handle increased data loads efficiently, which impacts productivity and agility.

Poor architecture-Lack of efficient data structures and algorithms may lead to longer processing times, affecting resource utilization. This can compromise the system's ability to handle growing data demands effectively, impacting the system's responsiveness, and hindering decision-making.

Failure to adhere to standards or protocols-Failure to adhere to industry standards affects interoperability, hindering seamless data exchange across systems. This

inconsistency can limit the system's ability to integrate with other applications, impacting its competitive advantage and data reliability.

Inappropriate security measures-Inappropriate security measures can compromise data integrity and confidentiality. Without robust encryption and access controls, data transmission becomes vulnerable to breaches, impacting the system's reliability and organizational trust.

2.6.3 ADDRESSING VENDOR CHALLENGES

Robust Infrastructure: Vendors must focus on integrating redundancy measures, such as backups and fail-safes, and utilizing technologies such as load balancing for optimized data distribution. This ensures uninterrupted service accessibility, even during surges in data loads.

Robust Architecture: Developing well-designed database schemas and scalable algorithms is crucial. Techniques such as data partitioning and horizontal scaling help to manage growing data volumes efficiently, minimizing processing times and resource utilization.

Standards or Protocols: Vendors should prioritize the adherence to industry standards such as HL7, DICOM, FHIR, HIPAA, ensuring seamless integration and data exchange. This ensures interoperability and compliance, improving the system's ability to integrate with other healthcare systems securely.

Secure Data Exchange: Implementing stringent security measures like encryption, access controls, and compliance with industry standards such as HIPAA is essential. This ensures secure data transmission, maintaining confidentiality, integrity, and availability of data.

6.3 LIMITATIONS OF THE RESEARCH

The qualitative approach of the study has limitations within it such as potential biases and limited generalizability. The study might not cover every aspect of data management systems due to the breadth of the subject. It might focus on specific industries or regions, potentially overlooking broader perspectives. Access to comprehensive and up-to-date information might be limited. Some vendors may not disclose proprietary information or may be reluctant to share specific details. However, the participants were told that the study is done for academic purposes only for them to express their views freely. The

limited time for research might restrict the depth of analysis or exploration of all potential facets related to vendor practices and data management systems. Constraints in financial resources or access to certain technologies can restrict the scope or implementation of proposed solutions. The researcher used her savings to overcome resources challenges and worked extra hours to overcome the time challenge.

6.4 RESEARCH CONTRIBUTIONS

This section presents the significance of this research regarding the contribution to practical, methodological, and theoretical contributions.

6.4.1 PRACTICAL CONTRIBUTIONS

This study makes substantial contributions to practice by providing actionable insights for vendors and organizations grappling with challenges in data management systems. Investigating how vendors address scalability issues through robust infrastructure, architecture, and cloud-based solutions offers practical guidance. These findings furnish a roadmap for organizations seeking to enhance their data systems' scalability, enabling them to accommodate increasing data volumes efficiently. Furthermore, the emphasis on interoperability standards, secure data exchange, and integration with third-party applications provides tangible strategies to ensure seamless communication between diverse systems. By outlining these practical approaches, this research equips practitioners with a toolkit to overcome obstacles that hinder efficient data-driven organizational processes.

6.4.2 METHODOLOGICAL CONTRIBUTIONS

Methodologically, this research presents a comprehensive approach to exploring and understanding the intricate landscape of data management systems. The study uses a qualitative research design, using in-depth interviews to collect nuanced insights from industry professionals. This methodological choice enabled a rich understanding of vendors' perspectives, allowing for the identification of key strategies and challenges they encounter. The structured thematic analysis employed in this study facilitates the extraction of pertinent information, providing a robust framework for dissecting complex issues related to scalability, interoperability, and the overall benefits of data management systems. This methodological contribution establishes a blueprint for future research

endeavours seeking to delve into similar domains, highlighting the efficacy of qualitative methodologies in uncovering nuanced industry perspectives.

6.4.3 THEORETICAL CONTRIBUTIONS

Theoretical contributions stem from aligning empirical findings with established frameworks and theoretical foundations within the realm of data management and organizational processes. This research bridges practical insights with theoretical concepts, demonstrating how vendors' strategies correspond to identified challenges, such as cybersecurity vulnerabilities, infrastructure scalability issues, and interoperability hurdles. By linking vendors' approaches to these challenges, this study bolsters existing theories in data management, offering empirical validation of theoretical frameworks. Furthermore, by emphasizing the role of emerging technologies such as AI, machine learning, and cloud computing in data management systems, this research extends theoretical discussions, highlighting the evolving landscape and the need for theoretical frameworks to adapt to technological advancements.

6.5 RECOMMENDATIONS

6.5.1 INVEST IN ROBUST INFRASTRUCTURE AND ARCHITECTURE

Managers must improve scalability in data management systems by prioritizing investments in resilient hardware, robust architecture design, and scalable components. Vendors should focus on adaptable architecture, distributed databases, and technologies such as data sharding and partitioning to effectively handle increasing workloads.

6.5.2 STANDARDIZE PROTOCOLS AND ENHANCE DATA SECURITY

Ensure adherence to industry-specific protocols and standards (HL7, DICOM, FHIR) To ensure harmonized data interpretation and secure data exchange across diverse systems. Strengthen data security measures with encryption, access controls, and compliance with regulations to safeguard data confidentiality, integrity, and availability.

6.5.3 FACILITATE SEAMLESS INTEGRATION AND INTEROPERABILITY

Management needs to provide robust, standardized data formats, middleware solutions, and pre-built connectors to facilitate seamless data flow and integration across diverse systems and applications. Prioritize interoperability to overcome disparities in data models and structures.

6.5.4 FOCUS ON FLEXIBILITY AND ADAPTABILITY

Organisations must develop systems that dynamically adjust to diverse data load patterns and irregularities. Prioritize flexibility in solutions to accommodate varied data consistency needs and efficiently handle large-scale data manipulation.

6.5.5 EMBRACE EMERGING TECHNOLOGIES AND CONTINUOUS IMPROVEMENT

Managers must integrate emerging technologies such as AI, machine learning, and block chain to enhance data management systems. Continually invest in research, monitor industry trends, forge partnerships, and upgrade teams to ensure that systems remain innovative, scalable, and capable of meeting evolving needs.

6.6 CONCLUSION AND FUTURE RESEARCH

Chapter 6 serves as the focal point of this research, encapsulating its findings and recommendations derived from a thorough investigation of vendor methodologies and obstacles within data management systems. Through the integration of empirical evidence and theoretical frameworks, this concluding chapter has illuminated the connection between identified challenges and vendors' strategies, offering significant practical and methodological insights into the realm of data-centric organizational processes. Furthermore, this chapter has forthrightly addressed the limitations of the study, provided recommendations, and set forth directions for future research efforts in this domain.

Future researchers may explore the following areas:

Longitudinal study: Conduct a longitudinal study to track the evolution of data management systems and vendor practices over time. Explore how technological advances, regulatory changes, and market demands have influenced the strategies used by vendors and their impact on organizational processes.

Cultural Impact: Investigate the cultural implications of data management practices. Analyse how different organizational cultures influence the adoption of data management systems, vendor selection criteria, and the success of implementation.

Ethical Considerations: Delve deeper into the ethical considerations related to data management. Explore the ethical dilemmas faced by organizations and vendors regarding data privacy, security, and responsible use of data. Investigate how vendors address these ethical concerns in their system designs.

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ANNEXURES

ANNEXURE A: ETHICAL CLEARANCE APPROVAL LETTER

Graduate School of Business Leadership_RERC

Ref #:2023_SBL_MBA_057_FA_1747
Name: Mrs Neo Gaaje
Student #: 57685886

Date: 25/10/2023

Dear: Mrs Neo Gaaje

Decision: Ethics Approval from October 2023 to December 2024

Researcher: Mrs Neo Gaaje

Bertha Gxowa Hospital, Villa Heidi Building, Germiston, Cnr Joubert and Hospital street

Johannesburg

neogaaje1@gmail.com 0110386814/0727261978

Supervisor: Dr Oluwamayowa Ogundaini ; ogundoo@unisa.ac.za

Exploring vendors' role in improving data management systems for enhanced organizational processes.

Qualification: MBA

Thank you for the application for research ethics clearance by the Graduate School of Business Leadership_RERC for the above-mentioned research study Ethics approval is granted for two years.

The **low-risk application** was **reviewed** by Graduate School of Business Leadership_RERC on 24 October 2023 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Graduate School of Business Leadership_RERC .
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.

7. No field work activities may continue after the expiry date (December 2024). Submission of a completed research ethics progress report will constitute an application for renewal, for Ethics Research Committee approval.

Additional Conditions

1. Disclosure of data to third parties is prohibited without explicit consent from Unisa.
2. De-identified data must be safely stored on password protected PCs.
3. Care should be taken by the researcher when publishing the results to protect the confidentiality and privacy of the university.
4. Adherence to the National Statement on Ethical Research and Publication practices, principle 7 referring to Social awareness, must be ensured: "Researchers and institutions must be sensitive to the potential impact of their research on society, marginal groups or individuals, and must consider these when weighing the benefits of the research against any harmful effects, with a view to minimising or avoiding the latter where possible." Unisa will not be liable for any failure to comply with this principle.

Note

The reference number 2023_SBL_MBA_057_FA_ 1747 should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.

Kind regards,

Prof N Mlitwa
Chair of Graduate School of Business Leadership_RERC
E-mail: wiltonb@unisa.ac.za

Prof P Msweli
Executive Dean / By delegation from the Executive Dean of Graduate School of Business Leadership_RERC
E-mail: mswelp@unisa.ac.za

ANNEXURE B: PERMISSION LETTER FROM THE ORGANISATION

Health System Technologies

67 Rosmead Avenue, Kenilworth, Cape Town, South Africa
Private Bag X5, Clareinch, 7740, South Africa
Tel: +27 (21) 683 1506
Fax: +27 (21) 674 2318
www.healthsystems.co.za

Date: 24 October 2023

GRANTING OF INSTITUTIONAL PERMISSION FOR RESEARCH

Dear Neo Gaaje

I, Adam Abdurahaman the Chief Operating Officer of this company grant permission to collect data at this site for your research project titled data management system.
I grant this permission as the authorized person to so in this company and am aware of the following,

1. The study is conducted as a UNISA researcher and remains the property of UNISA
2. You can use Health System Technologies, the name of the company, in your research project.
3. All data and information collected will be solely in the procession of the researcher.
4. The research may be published in the public domain under the supervision of the supervisor.

I wish the best and success in this research.

Signature A. Abdurahaman
Name: Adam Abdurahaman
Organisational Title: Chief Operating Officer
Full contact details: adam@healthsystems.co.za

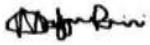
ANNEXURE C : SUPERVISOR LETTER OF CONSENT

CONSENT TO SUBMIT MBA / MBL RESEARCH REPORT FOR EXAMINATION 2023

Consent is hereby given to:

Student name: Neo Naome Gaaje

Student number: 57685886 to submit her research report in its final form.

Supervisor Signature:  Date: 19th December 2023

Supervisor Name: Dr O.O. Ogundaini

The student acknowledges that sufficient feedback was provided by the supervisor and that s/he took the responsibility to attend to the feedback in a way that satisfies the requirements of a doctoral degree on NQF level 9.

Student signature.....  Date: 19 December 2023

ANNEXURE D : INTERVIEW RESEARCH QUESTIONS

SECTION A: DEMOGRAPHIC DETAILS

a. How old are you?
b. What is your gender?
c. How long have you been working in the organisation?
d. What is your highest academic achievement?
e. Are you in the management or non-management?

SECTION B: RESEARCH QUESTIONS

Question 1: How do vendors address data management system quality to ensure scalability?

a. Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase.
b. How does the exponential increase of generated data during work affect performance levels of your systems?

Question 2: What are the technical requirements for interoperability when implementing data management systems?

c. What standards or protocols does your organisation consider when designing their data management systems?
d. How do these data management systems ensure secure data exchange between systems to prevent data breaches?
e. Are your data management systems designed to be able to integrate with other third-party applications? If yes, how? or No, why not?

Question 3: What are the overall net benefits attributed to data management systems?

f. Are there measures put in place to monitor how your data management systems support productivity of an organisation? If yes, please explain the measures? or No, why not?
g. Do you think your data management systems help organisations to reduce its cost?

Question 4: How can vendors improve data management systems to address the challenges of data-driven organizational processes?

h. What are the current challenges experienced by your organizations with regards to designing data management systems?
i. In your opinion, what are the areas of improvement that vendors should focus on to address the challenges experienced by your organisation?
j. In what ways do you plan to adapt your data management systems to keep up with evolving technologies and data management trends?

ANNEXURE E : CERTIFICATE OF LANGUAGE EDITING

Antinash Academic Coaching
261 Justice Mohamed Street
Muckeneuk, Pretoria
South Africa
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Email: antinashcounselling@gmail.com
Cell: (+27)848302282

To whom it may concern

RE: Confirmation of language editing- THE ROLE OF VENDORS IN ADDRESSING THE CHALLENGES OF DATA MANAGEMENT SYSTEMS TOWARDS IMPROVING DATA-DRIVEN ORGANISATIONAL PROCESSES

STUDENT'S NAME: Neo Naome Gaaje (57685886)

This letter serves to confirm that the above referenced thesis was language-edited by professional editors at Antinash Academic Coaching.

The edit included the following:

Spellings; Tenses; Vocabulary; Punctuation; Pronoun matches; Word usage; Sentence structure; Content (limited); and Format.

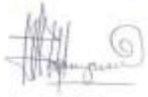
The edit excluded the following:

Correctness or truth of information (unless obvious); Correctness/spelling of specific technical terms and words (unless obvious); Correctness/spelling of unfamiliar names and proper nouns (unless obvious); Correctness of specific formulae or symbols or illustrations.

We confirm that the English language in this work is of acceptable standard.

The final corrections remain the responsibility of the author.

Yours Sincerely



Dr. L Chapungu

Director: Editorial services

ANNEXURE F : ANALYSIS PROCESS

Question 1: How do vendors address data management system quality to ensure scalability?		
DESCRIPTIVE CODES	**CATEGORIES**	**THEMES**
Resilient hardware X3	Hardware	Robust infrastructure
Redundant systems X2	Hardware	Robust infrastructure
Scalable technologies X3	Hardware	Robust infrastructure
Scalable design X2	Design	Robust architecture
Sharding X3	Design	Robust architecture
Caching mechanisms X3	Design	Robust architecture
Distributed processing X4	Virtualization	Citrix
Microservices architecture x4	Virtualization	Citrix
Elastic storage x3	Platform	Cloud-Based Server Storage Platform
Auto-scaling features for computing resources x3	Platform	Cloud-Based Server Storage Platform
Distributed databases/object storage x4	Platform	Cloud-Based Server Storage Platform
DESCRIPTIVE CODES	**CATEGORIES**	**THEMES**
Question 2: What are the technical requirements for interoperability when implementing data management systems?		
Industry Standards x2	Data Management Systems Design	Standards or protocols
Protocols x7	Data Management Systems Design	Standards or protocols
HL7x3	Data Management Systems Design	Standards or protocols
DICOM x5	Data Management Systems Design	Standards or protocols
FHIR X4	Data Management Systems Design	Standards or protocols
HIPAA x4	Data Management Systems Design	Standards or protocols
Security Measures X6	Secure Data Exchange	Ensuring Secure Data Exchange
Encryption, Access Controls, Compliance X4	Secure Data Exchange	Ensuring Secure Data Exchange
GDPR X2	Secure Data Exchange	Ensuring Secure Data Exchange
HIPAA X4	Secure Data Exchange	Ensuring Secure Data Exchange
APIs X3	Integration with Third-Party Apps	Integrate with other third-party applications
Interoperability Frameworks X3	Integration with Third-Party Apps	Integrate with other third-party applications
Standardized Data Formats X5	Integration with Third-Party Apps	Integrate with other third-party applications
DESCRIPTIVE CODES	**CATEGORIES**	**THEMES**
Question 3: What are the overall net benefits attributed to data management systems?		
SLAs X3	Monitoring & Tracking	Organizational productivity
Tracking KPIs X6	Monitoring & Tracking	Organizational productivity
Real-time access X5	Monitoring & Tracking	Organizational productivity
Automation X2	Monitoring & Tracking	Organizational productivity
Automation X4	Cost Reduction	Reduce costs
Strategic Decision-making X4	Cost Reduction	Reduce costs
Data accuracy X5	Cost Reduction	Reduce costs
Streamlining X7	Cost Reduction	Reduce costs
Operational efficiency X5	Cost Reduction	Reduce costs
DESCRIPTIVE CODES	**CATEGORIES**	**THEMES**
Question 4: How can vendors improve data management systems to address the challenges of data-driven organizational processes?		
Resource optimization X3	Cost Reduction	Reduce costs
Irregular Load X5	Consistency	Current challenges
Data Consistency across Applications X4	Integration	Current challenges
Cloud Integration X5	Large Data	Current challenges
Large-Scale Data Manipulation X4	Privacy	Current challenges
Data Privacy X6	Privacy	Current challenges
Consistent Handling X2	Adaptable Systems	Areas of improvement
Cloud Solutions X3	Consistent Data Handling	Areas of improvement
Large Data Solutions X3	Cloud Integration Solutions	Areas of improvement
Robust Privac X4	Large-Scale Data Solutions	Areas of improvement
Robust Privacy Measures X3	Robust Privacy Measures	Areas of improvement
Tech R&D X5	Tech Research & Development	Keeping up with evolving tech
Trends Monitoring X5	Industry Trends Monitoring	Keeping up with evolving tech
Partnerships X6	Partnerships & Team Upskilling	Keeping up with evolving tech
Emerging Integration X2	Integration of Emerging Tech	Keeping up with evolving tech
Human Infrastructure X3	Human Infrastructure Strengthening	Keeping up with evolving tech
Agile Strategies X4	Agile Data Management Strategies	Keeping up with evolving tech

1st ISSUE of INVESTIGATION	RESPONSE QUOTES	CODES
To investigate how vendors address data management system quality to ensure scalability in organisations. *Inquire about how organisation ensures the data management systems you develop can handle data growth as workload demands increase. *Describe the quality assurance processes employed to ensure scalability in your data management systems * Inquire how exponential increase of generated data during work affect performance levels of your systems	NG: Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase. Part 1: *At Health System Technologies (HST), we ensure that our data management systems can handle data growth as workload demands increase through scalable infrastructure and **robust architecture**. We employ technologies such as **distributed databases**, **data partitioning**, and **horizontal scaling** to accommodate growing data volumes effectively.* NG: Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase. Part 2: *At Our organization Health System Technologies (HST), we prioritize the **scalability and adaptability** of our data management systems to handle data growth as workload demands increase. We employ*	• Robust Architecture • Distributed Databases • Data Partitioning • Horizontal Scaling • Scalability and adaptability • robust infrastructure • utilize technologies. • horizontal scaling

	robust infrastructure *and utilize technologies that allow for* ***horizontal scaling****, ensuring that our systems can handle increased data volumes without compromising performance.* NG: Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase. *Part 3:* ***Cloud-Based Server Storage Platform*** *with ability to increase* ***data capacity****.* NG: Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase. *Part 4: At Our organization Health System Technologies (HST), we prioritize the scalability and* ***adaptability*** *of our data management systems to handle* ***data growth*** *as workload demands increase. We employ* ***robust infrastructure*** *and utilize technologies that allow for horizontal scaling, ensuring that*	• Cloud based. • Server storage • Storage platform • Data capacity • Robust infrastructure • Disk space • Global data

	our systems can handle increased data volumes without compromising performance. NG: Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase. *Part 5: **Robust infrastructure** is the backbone of our operations. We invest heavily in **scalable hardware** and redundant systems to ensure our services remain accessible even **during surges**. Load balancing and fail-safes are critical; they **distribute loads** evenly and protect against potential failures.* NG: Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase. Part 6: *"In our line of work, scalability is everything. Our infrastructure is designed to **expand seamlessly** with demand. We rely on load **balancing techniques** to evenly **distribute traffic**, and **scalable hardware** ensures we don't buckle under sudden spikes.*	• Adaptability • data growth • robust infrastructure • Robust infrastructure • scalable hardware • during surges • distribute loads.

	It's about keeping the user experience consistent, no matter the traffic. NG: Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase. *Part 7: Multiple different things are used for this.* ***Citrix*** *is used to boot up multiple instances of our applications which then gets provided to users via a* ***load balancer****. We also split our system in* ***multiple parts*** *so things that take a lot of* ***processing power*** *don't affect our main system like when big reports are ran."* NG: Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase. Participant 8: *To ensure* ***scalability*** *in our data management systems at Health Research Innovations (HRI), we prioritize* ***robust architecture,*** *employing various techniques that bolster our infrastructure to accommodate escalating* ***data demands*** *effectively.*	• Citrix • Load balancer • Processing power • Multiple parts • Robust architecture • Scalability • Data demand

	NG: Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase. Participant 9: ***Robust architecture*** *in our context refers to the design and implementation of a* ***resilient framework*** *that can seamlessly adapt to increasing* ***data volumes*** *and workload demands. It involves creating a solid foundation built on* ***scalable components*** *and methodologies.* NG: Kindly explain how your organisation ensures the data management systems you develop can handle data growth as workload demands increase. Part 10: Our **Cloud-Based Server Storage Platform** offers a dynamic and flexible infrastructure designed to accommodate expanding data requirements seamlessly. With the capability to augment data capacity on **demand**, our platform ensures businesses can scale their **storage** needs efficiently and without disruption.”	• Robust architecture • Resilient framework • Data volumes • Scalable components • Cloud based. • Server • Storage • Platform • demand

2nd ISSUE of INVESTIGATION	**RESPONSE QUOTES**	**CODES**
Technical requirements for interoperability when implementing data management systems. *Inquire about standards or protocols do you consider when designing data management systems *Inquire ways vendors cater for their data management systems to facilitate data exchange and integration between other existing systems in an organization *Inquire ways to ensure that your data management system can effectively integrate with various third-party applications and databases	NG: What standards or protocols does your organisation consider when designing their data management systems? *Part 1: When designing our data management systems, we adhere to industry **standards and protocols** such as **HL7, DICOM, FHIR, and HIPAA**. These standards ensure interoperability, data integrity, and compliance with **privacy and security regulations.** By following these protocols, we ensure that our systems can seamlessly integrate with other healthcare systems and exchange data securely.* NG: What standards or protocols does your organisation consider when designing their data management systems? *Part 3: **HL7 clinical document architecture and FHIR standards** to ensure data can be shared across applications. We need to verify that our database model has correctly defined tables, relationships, and are correctly	• Standards and protocols • HL7, DICOM, FHIR, and HIPAA. • Privacy and security • Regulations

	*indexed. When it comes to sending data to other third parties, we need to make sure that it conforms to the **HL7 international standard** messaging protocol for sending patient data, as well as for data to be available via a **SOAP web service**.* NG: What standards or protocols does your organisation consider when designing their data management systems? *Part 4: In healthcare, our considerations revolve around **electronic health record (EHR) systems, clinical data warehouses**, **and data analytics platforms.** These technologies allow for seamless data sharing among practitioners, enhancing evidence-based treatment and enabling predictive analytics. However, challenges in data privacy, security, and interoperability remain significant.* NG: What standards or protocols does your organisation consider when designing their data management systems? *Part 5: When designing our data management systems, we consider various*	• HL7 clinical document architecture and FHIR standards • HL7 international standard • SOAP web service • Electronic health record (EHR) • Clinical data warehouses • Data analytics platforms.

	*standards and protocols such as **HL7 (Health Level Seven), DICOM (Digital Imaging and Communications in Medicine), FHIR (Fast Healthcare Interoperability Resources), and HIPAA (Health Insurance Portability and Accountability Act).** These standards ensure interoperability, data exchange, and compliance with privacy and security regulations.* NG: How do these data management systems ensure secure data exchange between systems to prevent data breaches? Part 1: *All data **communication** runs through **SITA** which ensures that only specific **parties** have access on specific **ports** or via a **proxy server**.* NG: How do these data management systems ensure secure data exchange between systems to prevent data breaches? *Part 2: Our data management systems implement stringent **security** measures like **encryption,** access **controls**, and*	• HL7 (Health Level Seven) • DICOM (Digital Imaging and Communications in Medicine) • FHIR (Fast Healthcare Interoperability Resources) • HIPAA (Health Insurance Portability and Accountability Act). • Communication • SITA • Ports • Proxy server. • Parties

	*compliance with industry standards such as **HIPAA** in healthcare. However, despite these measures, challenges persist in ensuring secure data exchange due to the sensitivity of clinical data and the complex patient matching algorithms." Participant 3* NG: How do these data management systems ensure secure data exchange between systems to prevent data breaches? Part 3: *Our data management **systems** employ **encryption**, stringent access **controls,** and adherence to industry standards like **HIPAA** in healthcare to ensure secure data exchange. However, challenges persist due to the sensitivity of clinical data and the complexities in data sharing agreements and ethical policies, posing significant hurdles in achieving comprehensive security measures.* NG: How do these data management systems ensure secure data exchange between systems to prevent data breaches? *Part 4: Our **systems** incorporate **encryption, access** controls, and compliance with industry standards such as **HIPAA** to ensure*	• Security • Encryption • Controls • HIPAA

	secure data exchange. However, challenges persist due to the sensitive nature of clinical data, complex patient matching algorithms, and the need for stringent adherence to ethical policies and governing rules, posing obstacles in achieving seamless security measures. NG: How do these data management systems ensure secure data exchange between systems to prevent data breaches?	• Systems • Encryption • Controls • HIPAA
	Part 5: *Data **security** is of utmost importance to us. Our data management systems employ various security measures to ensure **secure** data **exchange** between systems and prevent data breaches. These measures include **encryption** techniques, access controls, user authentication, and regular security audits. We prioritize the **confidentiality**, integrity, and availability of data to maintain a secure environment for our clients.* NG: Are your data management systems designed to be able to integrate with other	• Systems • Encryption • Controls • HIPAA • Security • Secure • Exchange • Encryption • Confidentiality

	third-party applications? If yes, how? or no, why not? *Part 2: Yes, our data management systems are **designed** to **integrate** with other **third-party** applications. We achieve this using standardized **APIs** (Application Programming Interfaces) and interoperability frameworks. These enable seamless data **exchange** and integration with other healthcare systems and applications.* NG: Are your data management systems designed to be able to integrate with other third-party applications? If yes, how? or no, why not? *Part 4: Yes, our data management systems are designed for **integration with third-party applications using standardized data formats xAPI.** The utilization of APIs allows for secure and efficient integration, facilitating smooth data transfer.* NG: Are your data management systems designed to be able to integrate with other	• Designed • Integrate • Third party • APIs exchange • Integrate • Third party • xAPI

	third-party applications? If yes, how? or no, why not? *Part 5: Yes, we allow for **multiple** different **integrations** by use of **Intersystem** Ensemble interfaces that can cater to any needs. It allows us to transform our data to any messaging structure and add routing rules to send only specific messages. We also expose our data **via soap and rest web services.*** 	• Multiple • Different • Integration • Intersystem
3rd ISSUE of INVESTIGATION	**RESPONSE QUOTES**	**CODES**
Overall net benefits attributed to data management systems. *Inquire primary benefits that organizations derive from implementing data management systems *In quire about how data management system can help an organisation to reduce its cost	NG: In your experience, what are the primary benefits that organizations derive from implementing data management systems? Part 1: ***SLAs** for Infrastructure as a Service. All calls are logged, and resolution times **monitored.** As we can schedule daily tasks/processes to **automate** calculations, activities, and reporting on our data, that we can monitor on an ad hoc or daily measure.*	• SLA • Monitored • Automate

	NG: In your experience, what are the primary benefits that organizations derive from implementing data management systems? *Part 2: Absolutely, we have stringent measures in place to monitor the **productivity** bolstered by our DMS. We track data **accuracy, consistency, and reliability** as key indicators. It involves validating data through **automated** processes, ensuring clean and consistent information for confident decision-making.* NG: In your experience, what are the primary benefits that organizations derive from implementing data management systems? *Part 3: Our system employs real-time data access and validation techniques. We constantly monitor operational data to swiftly identify deviations and take corrective actions. It allows us to **streamline workflows, automate tasks, and improve collaboration across teams, ultimately enhancing productivity.***	• Productivity • Accuracy • Reliability • Consistency • Automated • Streamline • Workflows • Automates • Improve • Productivity

	NG: In your experience, what are the primary benefits that organizations derive from implementing data management systems? *Part 4: Yes, we have established robust mechanisms to monitor the **efficacy** of our DMS in enhancing operational **efficiency**. We focus on process automation, reducing manual intervention, and minimizing **errors**. Moreover, we emphasize data sharing and collaboration among departments, facilitating **smoother operations** and better **decision-making.*** NG: In your experience, what are the primary benefits that organizations derive from implementing data management systems? *Part 5: Monitoring **productivity** supported by our DMS is a **priority.** We evaluate how it enables us to gather, analyse, and interpret **large** volumes of data for both operational and strategic decision-making. It involves tracking KPIs, assessing **performance,** and **optimizing** operations using data-driven insights.*	• Efficacy • Operational • Efficiency • Minimize • Errors • Smoother • Decision making • Productivity • Priority • Large • Performance • Optimizing

	NG: In your experience, what are the primary benefits that organizations derive from implementing data management systems? *Part 6: We have implemented measures that revolve around utilizing DMS for **strategic** decision-making. This includes exploring large volumes of data, uncovering **valuable insights**, and simulating strategic options. It enables us to make **proactive** decisions based on simulations, reducing **uncertainties, and enhancing** our adaptability.* NG: In your experience, what are the primary benefits that organizations derive from implementing data management systems? *Part 7: We track **key performance** indicators (KPIs) such as system uptime, data processing **speed, and user satisfaction**. Additionally, we conduct regular performance evaluations and gather feedback from our clients to identify areas for **improvement** and ensure that our systems align with their productivity goals.*	• Strategic • Valuable • Insights • Proactive • Reducing • Enhancing • Key Performance • Speed • User Satisfaction • Improvement

	NG: In your experience, what are the primary benefits that organizations derive from implementing data management systems? *Part 8: We have measures in place to **monitor** how our data management systems **support** the **productivity** of an organization. These measures include performance monitoring, system uptime tracking, data analytics, and r**eporting capabilities**. They provide insights into system usage, efficiency, and overall productivity.* NG: Do you think your data management system can help an organisation to reduce its cost? *Part 1: Certainly, our DMS has contributed significantly to **cost reduction.** By automating tasks and streamlining workflows, we have cut down **operational expenses**. Moreover, its ability to provide real-time data access has improved our decision-making, optimised resource allocation and **minimizing unnecessary** costs.*	• Monitor • Support • Productivity • Reporting • Capabilities • Cost • Reduction • Operational • Expenses • Minimizing • Unnecessary

	NG: Do you think your data management system can help an organisation to reduce its cost? *Part 2: Our DMS plays a crucial role in **cost reduction**. It simplifies data management, ensuring data accuracy and reliability, thereby preventing **costly errors**. Additionally, the system's efficiency in facilitating strategic decision-making helps in optimizing resources and **minimizing** unnecessary expenditures.* NG: Do you think your data management system can help an organisation to reduce its cost? *Part 3: The impact of our DMS on cost **reduction** is **evident.** Through process **automation** and error reduction, it has streamlined operations, leading to **decreased** manual intervention and associated costs. Furthermore, by **leveraging** data-driven insights for decision-making, we have **optimized** resource allocation.*	• Reduction • Costly • Errors • Minimizing • Reduction • Evident • Automation • Decreased • Leveraging • Optimized

	NG: Do you think your data management system can help an organisation to reduce its cost? Part 4: *Absolutely, our DMS has been instrumental in **reducing organizational costs**. Its role in **enhancing** operational efficiency through automation and improved collaboration has directly resulted in cost **savings.** Additionally, using data insights for strategic decisions has optimized our **expenditures.*** NG: Do you think your data management system can help an organisation to reduce its cost? *Part 5: We have witnessed a noticeable **reduction** in costs due to our DMS. The system's ability to **automate** tasks, **improve data quality**, and enable strategic decision-making has led to streamlined operations and better resource allocation, ultimately **cutting down unnecessary expenses**.*	• Reducing • Costs • Enhancing • Saving • Expenditure • Reduction • Automate • Improve • Quality • Cutting • Unnecessary

	NG: Do you think your data management system can help an organisation to reduce its cost? *Part 6: These responses emphasize how organizations* ***leverage*** *their data management systems to* ***monitor productivity*** *and* ***reduce costs, aligning*** *with the advantages and purposes outlined in the literature provided. They highlight aspects such as data accuracy, operational efficiency, strategic decision-making, and automation, all contributing to* ***enhanced*** *productivity and cost reduction.* NG: Do you think your data management system can help an organisation to reduce its cost? *Part 7: Yes, by showing which departments are underperforming or over-taxed resources can be better* ***managed.*** *Systems are also automated which allows for* ***faster processing*** *of the required data gives patients better care and limits the chances for patients to return for the same causes which then* ***saves on costs.***	• Leverage • Monitor • Productivity • Reduce • Aligning • Enhanced • Managed • Faster • Processing • Saves • Costs

	NG: Do you think your data management system can help an organisation to reduce its cost? *Part 8: Our data management systems can **help organizations reduce costs.** By streamlining data processes, **improving efficiency, and enabling better** decision-making, our systems contribute to cost **savings** in areas such as data storage, data processing, and resource **utilization.*** NG: Do you think your data management system can help an organisation to reduce its cost? *Part 9: By streamlining data processes, **automating workflows, and eliminating manual data entry, our systems improve** operational efficiency and reduce the need for additional resources. Additionally, our **scalable infrastructure allows organizations to avoid costly** hardware investments and easily adapt to changing data requirements.*	• Help • Reduce • Costs • Improving • Efficiency • Better • Savings • Utilization • Automation • Workflow • Elimination • Improve • Scalable • Avoid • Costly

4th ISSUE of INVESTIGATION	**RESPONSE QUOTES**	**CODES**
How can vendors improve data management systems to address the challenges of data-driven organizational processes? *Inquire about how vendors ensure that their data management systems are adaptable to the evolving needs of data-driven organizational processes * Inquire about the areas of improvement that vendors should focus on to address the challenges experienced by your organisation *Inquire ways to adapt data management system to keep up with evolving data management trends and technologies	NG: In your opinion, what are the areas of improvement that vendors should focus on to address the challenges experienced by your organisation? *Part 1: Our struggle lies in efficiently **managing** irregular data load patterns, particularly facing **bottlenecks** during **peak** periods. Balancing the ebb and flow of data **influx** remains a significant challenge.* NG: In your opinion, what are the areas of improvement that vendors should focus on to address the challenges experienced by your organisation? *Part 2: One of our persistent challenges is maintaining data **consistency** across diverse applications, each with distinct requirements. Achieving **uniformity** while meeting varied demands remains an ongoing hurdle.*	• Managing • Bottlenecks • Peak • Influx • Consistency • Uniformity

	NG: In your opinion, what are the areas of improvement that vendors should focus on to address the challenges experienced by your organisation? *Part 3: The migration to **cloud** infrastructure has introduced added complexities. Integrating our data management solutions within this environment poses continuous challenges that demand **streamlined solutions.*** NG: In your opinion, what are the areas of improvement that vendors should focus on to address the challenges experienced by your organisation? *Part 4: Accessing, **modifying,** and searching through voluminous **files** efficiently poses a continual challenge. **Enhancing** the **speed** and efficacy of managing these sizable data sets remains a priority.* NG: In your opinion, what are the areas of improvement that vendors should focus on to	• Cloud • Streamed • Solution • Modifying • Files • Enhancing • Speed

	address the challenges experienced by your organisation? *Part 5: Safeguarding data **privacy,** especially in the face of **increasing digitization** of sensitive records, is a paramount concern. Balancing digitization benefits with stringent **privacy** measures is an ongoing challenge.* NG: In your opinion, what are the areas of improvement that vendors should focus on to address the challenges experienced by your organisation? *Part 6: Designing data management systems comes with its challenges. Some of the current challenges we experience include ensuring data **quality** and integrity, managing data privacy and security in a rapidly evolving landscape, and keeping up with the increasing complexity of healthcare data standards. **These challenges require continuous research, collaboration with industry experts, and staying updated with the latest technological advancements.***	• Privacy • Increasing • Digitalisation • Privacy • Quality • Research • Collaboration • Up to date • Technology

	NG: In your opinion, what are the areas of improvement that vendors should focus on to address the challenges experienced by your organisation? *Part 7: Vendors should focus on areas of improvement such as enhancing **data governance capabilities, implementing advanced analytics and machine learning** techniques for data quality assurance, and developing more **robust** privacy and security frameworks. Additionally, investing in interoperability standards and promoting data exchange between different healthcare systems would greatly benefit organizations in managing their data effectively.* NG: In your opinion, what are the areas of improvement that vendors should focus on to address the challenges experienced by your organisation?	• Data • Governance • Capabilities • Advanced • Analytics • Machine learning • Robust

	Part 8: Some of the current challenges experienced by our organization in designing data management systems include ensuring data privacy and security, ***managing the complexity of integrating diverse data sources, and keeping up with evolving regulatory requirements.*** NG: How do you prioritize user feedback and incorporate it into the continuous improvement of your data management system?	• Regulatory • Requirements • Managing
	Part 1: *Vendors should* ***prioritize developing solutions*** *capable of seamlessly managing irregular data load patterns. The ability to dynamically adjust to varying data* ***volumes*** *is crucial.* NG: How do you prioritize user feedback and incorporate it into the continuous improvement of your data management system?	• Prioritizing • Developing • Volumes
	Part 2: Improvements in ensuring consistent data across different applications are imperative. Vendors should focus on ***flexible solutions accommodating diverse*** *data consistency needs.*	• Flexible • Solutions • Accommodating • Diverse

	NG: How do you prioritize user feedback and incorporate it into the continuous improvement of your data management system? *Part 3: Enhanced **integration capabilities during cloud migration** are pivotal. Solutions that offer seamless data management within **cloud** environments will alleviate integration complexities.* NG: How do you prioritize user feedback and incorporate it into the continuous improvement of your data management system? *Part 4: **Innovations** in efficiently handling and manipulating large files would mark a significant **improvement.** Solutions that optimize processes for **large-scale** data manipulation are highly sought after.* NG: How do you prioritize user feedback and incorporate it into the continuous improvement of your data management system? *Part 5: Vendors must prioritize **robust data** privacy measures, especially considering the*	• Integration • Migration • Cloud • Innovation • Improvement • Large-scale • Robust • Data • Records • Regulatory

	*sensitivity of certain **records.** Tailored solutions meeting stringent **regulatory** requirements are indispensable.* NG: How do you prioritize user feedback and incorporate it into the continuous improvement of your data management system? *Part 6: In our opinion, vendors should focus on areas such as **enhanced data governance and privacy controls**, advanced data integration capabilities, and proactive monitoring and management tools to address the challenges experienced by our organization." Participant 10* NG: In what ways do you plan to adapt your data management system to keep up with evolving data management trends and technologies? Part 1: *Exploring **AI-powered** solutions to automate **data analysis** is on our radar. Personalized insights derived from **automated***	• Enhanced • Governance • Controls • Advanced • AI powered. • Data • Analysis • Automated

	processes are expected to enhance decision-making ***capabilities.***	• Capabilities • Block chain • Technology • Storage • Integrity
	NG: In what ways do you plan to adapt your data management system to keep up with evolving data management trends and technologies?	
	Part 2: Considering ***block chain technology*** *for secure* ***storage*** *and verification of records is part of our adaptation strategy. Exploring its potential to fortify data* ***integrity*** *is a key consideration.*	
	NG: In what ways do you plan to adapt your data management system to keep up with evolving data management trends and technologies?	
	Part 3: Embracing more ***scalable*** *solutions to efficiently handle* ***data*** *load fluctuations is in our roadmap. Scalability is pivotal in adapting to the dynamic nature of data* ***influx.***	• Scalable • Data • Influx

	NG: In what ways do you plan to adapt your data management system to keep up with evolving data management trends and technologies? *Part 4: **Investing in training** our staff on data privacy and security practices is a fundamental aspect of our adaptation **strategy**. Strengthening our human infrastructure is as crucial as enhancing **technological** frameworks.* NG: In what ways do you plan to adapt your data management system to keep up with evolving data management trends and technologies? *Part 5: Exploring **agile** data **management** strategies to swiftly adapt to emerging trends is a priority. **Flexibility** and adaptability in our systems will enable us to stay ahead in the **ever-evolving** landscape of data management.* NG: In what ways do you plan to adapt your data management system to keep up with	• Investing • Training • Strategy • Technological • Agile • Management • Flexibility • Ever evolving.

	evolving data management trends and technologies? *Part 6: To keep up with evolving **technologies** and data management trends, we have a proactive approach. We **invest** in **research and development** to stay at the forefront of emerging technologies such **as cloud computing, big data analytics, and artificial intelligence**. We actively monitor industry trends, collaborate with technology partners, and engage in continuous learning to adapt our data management systems accordingly. This ensures that our systems remain innovative, scalable, and capable of meeting the evolving needs of our clients and the healthcare industry.* NG: In what ways do you plan to adapt your data management system to keep up with evolving data management trends and technologies? *Part 7: To adapt our data management systems to evolving **technologies** and data management trends, we prioritize ongoing **research and development**. We actively*	• Technology • Invest • Research and development • Cloud • Computing • big data analytics • Artificial intelligence • Technologies • Research and development • Monitor

	monitor *industry advancements, engage in partnerships and collaborations, and invest in training and upskilling our teams. This allows us to incorporate emerging technologies, such as artificial intelligence, machine learning, and cloud computing, into our data management systems to stay at the forefront of innovation.*	

A: SCALABILITY

Subtheme	***Description***	***P 1***	***P 2***	***P 3***	***P 4***	***P 5***	***P 6***	***P 7***	***P 8***	***P 9***
Robust infrastructure	Vendors ensure scalability by investing in scalable hardware, employing redundancy measures (like backups and fail-safes), and utilizing technologies like load balancing to distribute data and workloads efficiently across servers.	*X*	*X*	*X*		*X*	*X*	*X*	*X*	
Robust architecture	Vendors ensure scalability by designing systems that can handle increased loads, implementing sharding (dividing a database into smaller, more manageable parts), employing caching mechanisms for faster access to frequently used data, and using distributed computing techniques.	*X*		*X*	*X*	*X*		*X*		*X*
Citrix	Citrix solutions can aid scalability by providing virtualized environments where applications and data can be centrally managed and accessed from various devices and locations.		*X*	*X*	*X*	*X*	*X*		*X*	*X*

Cloud-Based Server Storage Platform	Cloud-based server storage platforms, like Amazon Web Services (AWS), Microsoft Azure, or Google Cloud Platform, offer scalable storage and computing resources on demand.	*X*	*X*			*X*	*X*	*X*	*X*	*X*	

B*:* INTEROPERABILITY

Subtheme	***Description***	***P 1***	***P 2***	***P 3***	***P 4***	***P 5***	***P 6***	***P 7***	***P 8***	***P 9***	***P 10***
Standards or protocols	This involves adopting universally accepted structures such as XML, JSON, or industry-specific protocols. These standards provide a common language for data representation, facilitating seamless communication and interaction between different systems and databases.		*X*	*X*		*X*	*X*	*X*	*X*		*X*
Ensuring Secure Data Exchange	Security measures are imperative to safeguard data during exchange. Implementing encryption methods, robust transmission protocols like SSL/TLS, access control mechanisms, and data masking techniques are essential technical requirements.	*X*		*X*	*X*	*X*		*X*	*X*	*X*	*X*

Integrate with other third-party applications.	Interoperability with third-party applications demands efficient integration mechanisms. Employing Application Programming Interfaces (APIs), middleware solutions, or pre-built connectors becomes essential.		*X*	*X*	*X*	*X*	*X*		*X*	*X*	*X*

C: Overall benefits

Subtheme	**Description**	**P 1**	**P 2**	**P 3**	**P 4**	**P 5**	**P 6**	**P 7**	**P 8**	**P 9**	**P 10**
Support productivity	This involves adopting universally accepted structures such as XML, JSON, or industry-specific protocols. These standards provide a common language for data representation, facilitating seamless communication and interaction between different systems and databases.	*X*	*X*			*X*	*X*		*X*		*X*
Reduce costs.	Security measures are imperative to safeguard data during exchange. Implementing encryption methods, robust transmission protocols like SSL/TLS, access control mechanisms, and data masking techniques are essential technical requirements.	*X*		*X*	*X*			*X*	*X*	*X*	*X*

D: Improving data management systems

Subtheme	***Description***	***P 1***	***P 2***	***P 3***	***P 4***	***P 5***	***P 6***	***P 7***	***P 8***	***P 9***	***P 10***
Current challenges	This involves adopting universally accepted structures such as XML, JSON, or industry-specific protocols. These standards provide a common language for data representation, facilitating seamless communication and interaction between different systems and databases.	*X*	*X*	*X*	*X*	*X*	*X*	*X*	*X*		*X*
Areas of improvement	Security measures are imperative to safeguard data during exchange. Implementing encryption methods, robust transmission protocols like SSL/TLS, access control mechanisms, and data masking techniques are essential technical requirements.	*X*	*X*	*X*	*X*	*X*		*X*	*X*	*X*	*X*

Keep up with evolving technologies and data management trends											