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Improving Nigerian Army College of Environmental Science and Technology (NACEST) Makurdi Management Information System Through the Application of Database Management System (DBMS)

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ABSTRACT

This study examines the implementation of a Database Management System (DBMS) to improve the Management Information System at the Nigerian Army College of Environmental Science and Technology (NACEST), Makurdi. The research aims to reduce data duplication, enhance data access and security, enforce data standards, and shorten application timelines. A descriptive research design was adopted, and data was collected through questionnaires from 80 respondents. The findings reveal that the DBMS significantly reduces data duplication, improves data consistency, and enhances the speed and reliability of data access. The study concludes that the DBMS provides a more efficient, reliable, and secure framework for managing institutional information, making it an essential tool for improving administrative systems. Recommendations include continuous training for staff, regular updates and maintenance of the DBMS, and integration with all student-related processes.

Keywords: *DBMS, MIS, Data Access, Data Security, Data Standards.*

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INTRODUCTION

1.1 Background of the Study

In contemporary educational and institutional settings, the effective use of information technology has become central to organizational performance and decision-making. A Management Information System (MIS) is an integrated framework that collects, processes, Manipulate, stores, and disseminates information to support planning, control, and operational functions across an organization, including educational institutions. MIS enhances the accuracy, timeliness, and accessibility of information, which are critical for efficient administration, resource management, and strategic decision-making processes. Research has shown that MIS fosters improved performance, operational efficiency, and analytical capabilities within organizations by enabling systematic data handling and reporting. For example, studies on MIS implementation in Nigerian service industries and educational settings have found positive impacts on organizational performance and task execution (Lawal, R., & Afolayan, M. A. 2025).

Educational institutions such as the Nigerian Army College of Environmental Science and Technology (NACEST), Makurdi face growing needs for reliable and integrated information systems to manage student records, staff data, academic processes, and administrative functions effectively. NACEST is a federal tertiary institution that offers National Diploma and Higher National Diploma programmes and operates within both military and civilian environments, necessitating robust systems for academic and administrative management (Nigerian Army College Introduces Strategic Communication and Artificial Intelligence Programmes for 2025/2026 Session. 2025). Despite the presence of online portals and digital platforms for student registration and information access, many institutions still contend with challenges related to data redundancy, inconsistency, limited integration across administrative units, and inefficiencies associated with fragmented information processes.

1.2 Problem Statement

The Database Management System (DBMS) is not fully exploited in our educational system, particularly in most of the nation's post-secondary schools. Unfortunately, institutions are unable to effectively use technology in databases because they cannot show that their acquisition of ICT has had an impact. As a result, the "Filing System" technique still governs the Storage System. Using database management systems (DBMS) as a storage tool, which attempts to serve particular methods in the data storage practice, may significantly aid in reducing such purported concerns.

An operating system that is more traditional provides support for this type of file processing mechanism. The system keeps permanent records in a number of files, and in order to get records from and add records to the relevant files, it requires a variety of application programs. Organizations typically used these systems to store information prior to the introduction of database management systems (DBMS).

1.3 The Aim and Objective

The aim of this research is to improve Nigerian Army College of Environmental Science and Technology (NACEST) Makurdi Management Information System through the Application of Database Management System (DBMS). While the specific objective are to:

i. Ascertain whether a database system will be more helpful than a traditional filing system in preventing data duplication.

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ii. Ascertain whether a database system will make data easier to access for the college's information system and how a standard filing system influences the data security rate in NACEST.

iii. Evaluate the impact that a standard filing system has on the college's information system's ability to enforce data standards.

iv. Determine whether using a database management system (DBMS) will shorten the application process

1.4 Research Question

The following research questions were raised for the study:

1. To what extent does a database management system (DBMS) reduce instances of data duplication within NACEST's administrative processes compared to the existing traditional filing system?
2. How does the implementation of a DBMS improve the speed and reliability of data access for NACEST's information system, and what is the comparative impact on data security rates between a DBMS and a standard filing system?
3. What impact does the use of a standard filing system have on the ability of NACEST's college information system to enforce consistent data entry and reporting standards?
4. Does the adoption of a Database Management System (DBMS) shorten the duration

REVIEW OF RELATED LITERATURE

2.1 Introduction

This literature review establishes that manual filing systems in Nigerian institutions create data inefficiencies, while Database Management Systems (DBMS) theoretically offer superior data control and access. It highlights the practical application of DBMS in education to streamline administrative and academic functions. However, a significant gap exists in research tailored to the specific operational and infrastructural context of Nigerian defense sector colleges like NACEST. Therefore, this review frames the current study as a necessary investigation into implementing a context-specific DBMS solution at NACEST Makurdi.

The chapter is segmented into the following sub theme:

I. Application of Database Systems in Information Management
II. Management Information Systems (MIS)
III. Information System Resources
IV. Theoretical Models: Foundations of Database Design

2.2 Application of Database Systems in Information Management

Database Management Systems (DBMS) are specialized software designed to store, organize, manage, and retrieve data efficiently and securely. A DBMS serves as an intermediary between users and databases by supporting operations such as data insertion, update, deletion, and querying while ensuring consistency and integrity of stored information (TechTarget, 2024). Beyond simple storage, DBMS encapsulate advanced mechanisms for concurrency control, transaction management, and backup/recovery, enabling robust and reliable information management in modern systems (TechTarget, 2024).

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Fundamentally, DBMS eliminate the redundancy and inconsistency that characterize file-based systems by enforcing a centralized and structured data model, which enables efficient storage and retrieval of information (OpenStax, 2025). Through schema definition, normalization, and transaction control, DBMS provide a logical abstraction layer that allows applications and users to interact with data without knowledge of its physical implementation (OpenStax, 2025).

2.2.1 Evolution and Varieties of Database Systems

The evolution of database systems reflects a shift from early hierarchical and network models to the more flexible and widely used relational model. The relational paradigm, introduced by Codd, organizes data into tables linked by defined relationships, enabling developers to perform powerful queries using Structured Query Language (SQL) (Deng, 2024). More recently, the proliferation of large-scale, heterogeneous, and unstructured data has driven the emergence of NoSQL and hybrid database systems, which offer flexible schemas and scalable architectures tailored for Big Data applications (Khan et al., 2023). These advancements broaden the scope of DBMS by catering to diverse data types, workloads, and performance requirements (Khan et al., 2023).

2.2.2 Enhancing Organizational Information Management

One of the most widely cited benefits of database systems is their ability to enhance organizational information management through improved data accessibility, integration, and accuracy. In enterprise environments, DBMS facilitate integrated information flows across functional domains such as finance, human resources, marketing, and operations, supporting decision-making and strategic planning through centralized data repositories (Deng, 2024). Across sectors, organizations rely on DBMS to automate routine data management tasks, reducing manual errors and increasing operational efficiency (TechTarget, 2024).

For instance, in educational institutions, relational databases are deployed to manage student records, course enrollments, faculty information, and academic performance metrics. Such systems improve retrieval speed, ensure data consistency, and support administrative workflows (Azuddin et al., 2025). Similarly, government agencies utilize DBMS to manage citizen databases, tax records, and regulatory data, enhancing transparency, service delivery, and policy formulation (CCBP.in, 2025).

2.2.3 Information Retrieval and Analytical Capabilities

Database systems significantly impact information retrieval and analytics, enabling structured query processing, intelligent indexing, and transaction control (Database Management System and Information Retrieval, 2018). In environments where rapid retrieval of relevant information is essential, databases support efficient indexing and query optimization techniques to facilitate timely data access. However, literature also highlights limitations when integrating full-text search capabilities into conventional DBMS, pointing to performance and scalability constraints unless augmented with specialized search architectures (Database Management System and Information Retrieval, 2018).

Moreover, the integration of DBMS with analytics and business intelligence tools allows organizations to derive insights from stored data. By supporting classification, trend analysis, and predictive modeling, database systems help decision makers

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uncover patterns and make evidence-based decisions. As data volumes grow, hybrid data architectures (combining relational and NoSQL models) provide greater flexibility and performance for complex analytical workloads (Khan et al., 2023).

2.2.4 Security, Integrity, and Reliability

Maintaining data security and integrity is a cornerstone of effective information management. Modern database systems offer robust security features including authentication, role-based access control, data encryption, and auditing, which are critical to protecting sensitive and confidential information (TechTarget, 2024; BCom Institute, n.d.). Transaction management mechanisms that enforce ACID (Atomicity, Consistency, Isolation, Durability) principles ensure consistency and reliability, particularly in mission-critical applications such as financial systems where data accuracy must be guaranteed (OpenStax, 2025).

Backup and disaster recovery features further enhance information management by allowing systems to restore data to a consistent state after hardware failures, software errors, or other catastrophic events (OpenStax, 2025). These built-in capabilities reduce downtime and protect against irreversible data loss, making DBMS indispensable for organizational resilience.

2.2.5 Applications Across Domains

Enterprise and Retail: Databases manage customer relationships, inventory, sales transactions, and supply chain operations, supporting real-time decision making and enhanced user experiences (CCBP.in, 2025).

Education: Academic institutions implement databases to support administrative workflows, student information systems, and academic reporting (Azuddin et al., 2025).

Public Sector: Government agencies use DBMS to facilitate public records management, social services, and regulatory databases, improving accountability and transparency (CCBP.in, 2025).

Telecommunications and Finance: Telecommunications firms rely on database systems to store call records, billing data, and network performance metrics, while financial institutions use them for secure transaction processing and fraud detection (CCBP.in, 2025).

2.2.6 Emerging Trends and Challenges

With the advent of Big Data, Internet of Things (IoT), and real-time analytics, database systems must evolve to handle massive volumes of streaming and unstructured data. Future research and development focus on automation, self-healing databases, and seamless integration with distributed computing environments such as cloud platforms and edge computing (TechChamp, 2025; Khan et al., 2023). These trends reflect the need for scalable, flexible, and intelligent database systems that support real-time decision making and advanced analytics.

Despite these advances, challenges remain in balancing performance, security, and cost. Enterprises often face trade-offs between the scalability of distributed NoSQL systems and the transactional integrity of traditional relational databases, prompting the development of hybrid architectures that mitigate each approach’s limitations (Khan et al., 2023).

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2.3 Management Information Systems (MIS)

Management Information Systems (MIS) are specialized information systems designed to support managerial decision making, organizational coordination, control, and planning by providing timely, accurate, and relevant information (Wikipedia, 2026). Fundamentally, MIS integrates people, processes, and technology in a framework that enables managers to collect, process, store, and retrieve data necessary for planning, monitoring, and operational control (Wikipedia, 2026). In early conceptualizations, MIS has been defined as an organized combination of people, procedures, databases, and communication technology that supports managerial decision processes by transforming raw data into meaningful information (International Journal of Computer Applications, 2026). Across literature, the central objective of MIS is to enhance the quality of managerial decisions and contribute to organizational performance, productivity, and strategic effectiveness (Sari & Priantinah, 2019; Mishra & Pradhan, 2019).

2.3.1 Core Characteristics of MIS

MIS is characterized by its systematic structure and focus on three interconnected domains: people, technology, and organizational processes. The components of MIS include hardware and software infrastructure, data sources, procedures for data collection and processing, and user interfaces for information dissemination (Fila, Mursid, & Caniago, 2025). These elements work together to ensure that information flows appropriately within and across organizational levels, enabling a unified approach to data management and decision support (Fila et al., 2025). Notably, MIS provides structured data reports that help managers evaluate performance, monitor tasks, and make both strategic and operational decisions, distinguishing it from other types of information systems like transaction processing systems (Wikipedia, 2026).

2.3.2 Role of MIS in Decision Making and Organizational Performance

A substantial body of research highlights the role of MIS in enhancing managerial decision making. MIS strengthens decisions by consolidating data from diverse organizational functions into coherent information outputs tailored to managerial needs (Sari & Priantinah, 2019; Mishra & Pradhan, 2019). According to Novita Sari and Priantinah (2019), high quality data collection under MIS improves the accuracy and speed of managerial decision making, which in turn boosts operational efficiency and strategic planning. Moreover, MIS facilitates managers' ability to forecast outcomes, analyze trends, and assess alternative strategies, thereby improving responsiveness to environmental changes and competitive conditions (Journal of Economic and Business Studies, 2026).

Empirical research also shows that MIS adoption improves business performance by automating daily tasks, reducing human errors, and providing timely insights that support strategic actions. For example, a study on business organizations in Adamawa State, Nigeria, found that MIS increases operational efficiency, enhances staff monitoring, and supports strategic decision making, leading to better overall performance (Texila Journal, 2026).

2.3.3 Benefits and Organizational Impact

Improved Decision Accuracy: MIS enhances the accuracy of decisions by synthesizing data from various sources and presenting it in refined, context-rich

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formats, enabling managers to base decisions on reliable information (International Journal of Applied Research, 2026).

Operational Efficiency: By automating information processing and reporting, MIS reduces the time and cost required to gather, analyze, and disseminate information across business units, facilitating faster operational responses (International Journal of Applied Research, 2026).

Communication and Collaboration: MIS facilitates better communication among departments by integrating data streams and enabling shared access to common information, which improves coordination and reduces redundancy (Journal of Economic and Business Studies, 2026).

Strategic Competitive Advantage: In the digital age, MIS supports analytics, forecasting, and scenario planning, enabling firms to innovate, respond to market trends, and maintain competitive positioning (Lubis & Nasution, 2026).

2.3.4 Challenges in Implementation

Despite its advantages, MIS also poses significant implementation challenges. Studies identify cost, data security, integration complexity, and staff resistance as major barriers to effective MIS deployment. High initial investment in hardware, software, and training often limits adoption, especially in resource-constrained environments (Educatly, 2026; Stuurman, 2026). Additionally, inadequate infrastructure and limited technical skills among employees can impede proper utilization and reduce the potential benefits of MIS (Educatly, 2026; Stuurman, 2026). Resistance to change from employees accustomed to manual processes further undermines implementation success unless complemented by robust change management strategies (ResearchGate, 2026).

2.3.5 Technological Trends and Future Directions

Recent research emphasizes the evolving nature of MIS in response to technological advancements such as cloud computing, artificial intelligence (AI), and big data analytics. Modern MIS architectures increasingly leverage cloud platforms to deliver scalability, real-time data access, and reduced maintenance costs, while AI and machine learning enhance predictive analytics and decision support capabilities. These innovations position MIS as a strategic asset that not only supports routine reporting but also enables automated insights that drive business intelligence (Mahmoud et al., 2026). However, integrating advanced technologies also introduces new challenges in data governance, system interoperability, and cybersecurity that require ongoing attention from managers and IT professionals.

2.4 Information System Resources

Information system resources are the fundamental components that enable any information system to collect, process, store, transmit, and disseminate data into meaningful information that supports organizational operations, decision making, communication, and strategic goals. According to systems theory, an information system is a set of interrelated elements that work together to achieve information processing objectives (OpenStax, 2025). These elements — broadly referred to as resources — provide the necessary capabilities for information systems to function effectively within an organization.

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Scholars and practitioners widely agree that information system resources are multidimensional and include both technological and human elements that collectively determine the system's capacity to generate value (Ross, Beath, & Goodhue as cited in literature on IS resource classification) .

2.4.1 Classification and Component Framework

People resources

People are arguably the most essential element of any information system. They include both end users — individuals who interact with the system to perform tasks, input data, and consume information — and information system specialists such as systems analysts, developers, network administrators, and database managers who design, implement, operate, and maintain the system (TechTarget; scholarly IS models) . The competence, skills, and experience of these individuals significantly influence the quality of system outputs, user adoption, innovation, and overall effectiveness of the system.

Hardware Resources

Hardware refers to all physical technological devices required for information processing, storage, and output — including servers, computers, workstations, storage devices, printers, scanners, and related peripherals (OpenStax, 2025; MIS foundational texts) . Hardware forms the infrastructure upon which software runs and data flows, making it indispensable in transforming raw data into usable information.

Software Resources

Software encompasses both system software (such as operating systems that manage hardware functions) and application software (programs that perform specific user tasks like payroll, inventory control, report generation, etc.). Software is responsible for executing instructions that process data according to organizational needs (OpenStax, 2025; MIS resources frameworks) .

Data Resources

Data constitutes the raw material of information systems, composed of facts, figures, records, and files that the system collects and processes (OpenStax, 2025). These data resources are often organized into databases or knowledge bases that enable efficient retrieval, storage, and analysis (OpenStax, 2025; MIS foundational literature) . Quality, relevance, and accessibility of data are directly linked to the value of the information products generated by the system.

Network Resources

Networks refer to the communication infrastructure that connects hardware and users, enabling data transfer both within and beyond organizational boundaries. This includes communication media (wired and wireless), networking hardware (routers, switches), and software supporting connectivity, security, and data flow (MIS resources literature).

Together, these resources form the backbone of an information system, enabling it to perform the key activities of input, processing, output, storage, and control — the core operations that convert raw data into useful information products for decision makers (MIS models).

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2.4.2 Resource-Based View in Information Systems

Beyond the component-level view, literature grounded in the Resource-Based View (RBV) expands the concept of information system resources to include intangible assets and capabilities that contribute to competitive advantage. Under this lens, information system resources are not just static elements but strategic assets that create value when combined effectively (Mata, Armstrong & Sambamurthy, Bharadwaj as cited in IS resource studies)

Scholars classify IS resources into three broad categories under RBV:

Technical Resources: These include physical IT assets such as hardware, software, databases, and network platforms that enable information processing and communication.

Human Resources: Skills, expertise, and know-how possessed by IT professionals, including technical, managerial, communication, and innovation skills.

Intangible or Relationship Resources: These involve organizational culture, process know-how, vendor partnerships, internal and external user relationships, and shared risk management practices (Ross et al., Bharadwaj, Bassellier & Benbasat, as cited in RBV literature).

This extended framework emphasizes that IT capabilities emerge not just from possessing resources but from mobilizing them in ways that are valuable, rare, difficult to imitate, and non-substitutable, thereby positively influencing organizational performance and resilience.

2.4.3 Resource Integration and Information Security

Research also highlights the connection between information system resources and information security. Effective resource management — especially in technology and human capabilities — directly impacts how well information systems resist unauthorized access and protect sensitive data. Studies show that technology assets, human skills, and relationship networks are foundational to securing information systems and maintaining confidentiality, integrity, and availability (IS security research)

2.5 Theoretical Models Foundations of Database Design

Database design is the process by which data structures are defined to ensure that information is stored, retrieved, and maintained efficiently, reliably, and with semantic clarity. At its core, database design theory consists of formal models that guide how data should be conceptualized and structured before physical implementation. These models serve as the scientific and logical foundation for database design — enabling designers to produce systems that are consistent, scalable, and aligned with business requirements.

The theoretical underpinnings of database design stem from early work in formal mathematical models, such as the relational model proposed by Edgar F. Codd in the 1970s, and conceptual modeling frameworks like the Entity-Relationship (ER) model introduced by Peter Chen. Both frameworks, together with normalization theory and extension models like the Enhanced Entity-Relationship (EER) model, have shaped modern database design practice and research (Codd, 1970s; Chen, 1976).

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2.5.1 Relational Model: Mathematical Basis of DBMS

The Relational Model is widely regarded as the foundational theoretical model for database design and technology. First articulated by Edgar F. Codd while at IBM, the relational model represents data as sets of relations (tables) where rows are tuples and columns are attributes. Its strength lies in its formal mathematical basis: relational algebra and calculus provide precise semantics for data manipulation and retrieval (TechTarget, 2024; Cambridge University Press, 2018). Its logical consistency and simplicity enabled relational databases to become the dominant paradigm for transactional systems across industries.

Codd further proposed a set of rules — often called Codd's 12 rules — to define what constitutes a true relational database system. These rules formalize principles such as data independence, guaranteed access, and systematic treatment of null values, reinforcing the theoretical rigor of the relational approach (Codd's 12 rules, 1985).

2.5.2 Entity-Relationship (ER) Model: Conceptual Foundation

While the relational model provides a logical structure for how data is stored and manipulated, conceptual modeling deals with how data needs and relationships are represented during early stages of design. The Entity-Relationship (ER) model, introduced by Peter Chen, facilitates this by using entities, attributes, and relationships to depict real-world systems at a high level (Peter Pin-Shan Chen's ER Model, n.d.). ER diagrams provide a graphical representation that improves communication between stakeholders and database designers, allowing for clear specification of constraints and associations before implementation.

The ER model's theoretical basis lies in representing entities (objects of interest), attributes (properties of entities), and relationships (links between entities). These concepts enable designers to abstract domain knowledge into formal structures that can be mapped to relational schemas (Teorey et al., 2011).

However, research also discusses limitations of the original ER model — particularly its static nature and reductionist abstraction — prompting extensions and analytical approaches designed to align it more directly with relational semantics (Al-Fedaghi, 2025).

2.5.3 Enhanced Entity-Relationship (EER) Model

To address the complexity of real-world database requirements, researchers extended the basic ER model to the Enhanced Entity-Relationship (EER) model. EER includes additional semantic constructs such as specialization/generalization hierarchies, inheritance, and union types (categories), allowing more accurate modeling of complex domains (Elmasri & Navathe, 1980s).

These enhancements permit designers to represent superclass/subclass relationships, constraints on membership in hierarchies, and more nuanced classification — features important in domains like engineering systems, geographic information systems (GIS), and large-scale enterprise applications. By retaining the foundational elements of the ER model while extending its expressiveness, EER serves as a bridge between conceptual and logical design phases.

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2.5.4 Normalization Theory: Ensuring Data Integrity

Another essential theoretical pillar in database design is normalization theory, which provides a set of formal rules for structuring relational schemas such that redundancy and update anomalies are minimized. Normal forms — from First Normal Form (1NF) through advanced forms like Third Normal Form (3NF) and Boyce-Codd Normal Form (BCNF)are based on functional dependency theory and relational algebra.

Normalization is not just a practical rule of thumb; it is deeply grounded in relational theory: each normal form corresponds to specific logical conditions that prevent certain classes of anomalies. C. J. Date's work, Database Design and Relational Theory, expands on these principles, showing that strong normalization leads to robust schema designs adaptable over time (Date, 2019).

The Principle of Orthogonal Design further complements normalization by ensuring no two relations in a database represent the same facts, eliminating redundancy and expressive ambiguity in schema definitions (McGovern& Date, 1994).

2.5.5 Conceptual Schema Theory

Alongside these models, the notion of a conceptual schema plays a theoretical role in database design. A conceptual schema is a high-level description of the informational needs of an organization, focusing on entities, relationships, constraints, and data types without concern for physical storage details (Conceptual schema, n.d.).

Conceptual schemas serve to decouple design concerns: they allow stakeholders and designers to agree on a domain's structure before translating it into logical and physical schemas. This theory of layered modeling — conceptual → logical → physical — underpins modern database development methodologies.

2.5.6 NoSQL and Non-Relational Data Models

While relational and ER theories have dominated for decades, the rise of NoSQL databases (key-value stores, document databases, graph databases) expands theoretical models to accommodate semi-structured and unstructured data that relational models struggle with. Recent literature surveys systematic approaches to NoSQL database modeling, emphasizing how new conceptual frameworks are developing to support schema flexibility and heterogeneous data types (NoSQL Database Modeling Review, 2023).

These models challenge traditional theoretical assumptions — for example, strict schema definitions and ACID constraints — and extend the theoretical foundation of database design to include schema-on-read approaches and flexible relations between entities.

2.6 Summary of Related Literature

The reviewed literature establishes that database systems and information systems are fundamentally grounded in strong theoretical and conceptual models that guide effective data organization, storage, and utilization. Foundational theories such as the relational model provide the mathematical and logical basis for modern database management systems, ensuring data integrity, consistency, and independence. Complementing this, conceptual models—notably the Entity-Relationship (ER) and

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Enhanced Entity-Relationship (EER) models—enable designers to represent real-world entities and relationships clearly, facilitating accurate translation of organizational requirements into logical database structures.

Normalization theory further strengthens database design by reducing redundancy and preventing update anomalies, thereby improving data quality and long-term maintainability. The literature also emphasizes the importance of conceptual schemas in separating user requirements from physical implementation, allowing flexibility and scalability in system development. In recent studies, emerging NoSQL and non-relational models extend traditional theories to address the growing need to manage large volumes of semi-structured and unstructured data in modern organizations.

Overall, the literature confirms that effective information management depends on the proper application of database design theories and information system resources. These theoretical foundations not only support efficient data processing and decision-making but also enhance organizational performance, adaptability, and competitiveness in an increasingly data-driven environment.

METHODOLOGY

3.1 Introduction

This chapter deals with the processes and steps taken in carrying out this research. The chapter contains the following sub- headings

1. Research Design
2. Area of the Study
3. Population of the Study
4. Sample and Sampling Technique
5. Instrument for Data Collection
6. Validation of Research Instrument
7. Method of Data Collection
8. Method of Data Analysis

3.2 Research Design

This study adopts a descriptive research design to examine the application of database systems in information management. A descriptive research design is appropriate because it enables the researcher to systematically describe existing practices, conditions, and relationships as they naturally occur without manipulating variables (Creswell, 2014). This design is widely used in information systems research to assess how technologies are applied within organizations and their impact on decision-making processes (Sekaran & Bougie, 2016).

3.3 Population of the Study

The population for this study consists of 1,000 Small Medium and ICT Enterprises (SMICTES) in Abuja Metropolis of Federal Capital Territory (1,000 retrieved from Computer Professional of Nigeria CPN, 2023). The manager and secretariat of each organization serve as the study respondents.

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3.4 Sample and Sampling Techniques

The researcher adopted the use of proportion random sampling by one over ten (1/10). i.e. ten percent (10%) of the whole population. Therefore, one hundred (100) sample of respondents are selected out of the population of one thousand (1,000).

3.5 Instrument for Data Collection

The instrument used for data collection for this study was questionnaire using, questionnaire was chosen because of its wider coverage. The questionnaire was considered more suitable in organizations like the Information and communication industry in which the various respondents have various educational background and experience. The questionnaires were design in such a way respondents choose appropriate answers from options. The questionnaire starts with an introductory letter for the respondent. This part of the questionnaire contain letter to the respondents introducing the topic of the research, the address of the researcher, details of the researcher soliciting the respondents to answer the question for the research. The other parts are Section A and B with section A contains the details (Bio-data) of the respondents such as Age, Marital status and educational background and the last in section A is the analysis of the rating scale of Strongly Agreed with 5points, agreed with 4 points, Undecided with 3 points, disagreed with 2 points and Strongly Agreed with 1 point. The Section B contains statement of the research questions constructed for the respondents to answer.

3.6 Validation of the Instrument

For validity of the content used, the questionnaires were validated by three professionals, two senior lecturers in the Department of Computer Science and one researcher. Which took time to make the necessary correction in making the questionnaire valid.

3.7 Method of Data Collection

The researcher personally administered 100 questionnaires to the selected respondents, and retrieves 80 from the respondents personally as well.

3.8 Method of Data Analysis

The data collected from the respondents were presented in tables and figures and analyzed using simple percentage (%) and mean statistics. 5-point rating scale was used of strongly agree, agree, undecided, disagree and strongly disagree. Thus, any mean equal or greater than 2.5 is accepted and any mean lower than 2.5 is rejected.

$$\bar{x}\bar{x} = \frac{\sum fx}{N}\frac{\sum fx}{N}$$

Where:

$\bar{x}\bar{x}$ = Stands for mean (average)

$\sum = \sum$ = Summation

F = Frequency

xx = Weight

NN = Total number of responses

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DATA PRESENTATION, ANALYSIS, FINDINGS AND DISCUSSIONS

4.1 Introduction

In this chapter, analysis of all the data collected from the questionnaires prepared and administered. The rates were presented in tables and charts and analysis to show their frequencies and percentages.

4.2 Presentation and Interpretation of Data

In this chapter, analysis of all data collected from the questionnaires was made by presenting them in tables to show frequencies and percentages of the respondents. However, 100 questionnaires were prepared and distributed to the selected small and Medium ICT Enterprises (SMICTES) in Abuja. Out of the 100 questionnaires only 80 were retrieved and analyzed in order to provide a clear interpretation of data obtained and also to arrive at a logical conclusion.

Table 1: Analyses of Questionnaires Distributed and Retrieved from Respondents

S/NO	ITEMS	RESPONDENTS	PERCENTAGE (%)
1.	Number of Questionnaires Administered	100	100%
2.	Number of Questionnaires Returned	80	80%
3.	Number of Questionnaires not Returned	20	20%
	TOTAL	**100**	**100%**

Note that the mean method of statistical computation and analysis was used to analyze the data and it was mathematically represented as $\bar{x} = \frac{\sum fx}{N}$ analysis of questionnaire basic information.

Table 2: Ages of Respondents

S/N	Age	Frequency	Percentage (%)
1.	**17-20**	10	12.5
2.	**21-30**	35	43.75
3.	**31-40**	31	38.75
4.	**41 and Above**	4	5
	Total	80	100

Table 2 revealed that majority respondents within the age 21-30 constitute 43.75% of the distribution, while 38.75% of the respondents are within age group of 31-40 years of age, 12.5% of the respondents are within the age group of 17-20 and 5% of the respondents are within age group of 41 and above years of age. This connotes that majority of the employees in the company were within the age group of 21-30 years of age

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Table 3: Distribution according to Educational status of respondents

S/N	Educational Status	Frequency	Percentage (%)
1.	**Secondary**	8	10
2.	**ND**	35	43.75
3.	**HND**	4	5
4.	**BSc/B.A**	32	40
5.	**Masters**	1	1.25
	Total	80	100

Table 3 revealed that majority respondents are National Diploma holders with 43.75%, followed by Higher National Diploma 5%, Secondary school holders 10%, BSc/B.A40% and Masters Holders 1.25%. This connotes that majority of the employees in the study are National Diploma holders.

Research Question 1: To what extent does a database management system (DBMS) reduce instances of data duplication within NACEST's administrative processes compared to the existing traditional filing system?

Table 4: Ascertain whether a database system will be more helpful than a traditional filing system in preventing data duplication.

S/N	STATEMENT	SA	A	UD	D	SDA	Mean $\bar{X}$	Remark
1.	To what extent has the use of a Database Management System (DBMS) reduced the repetition of the same data across different administrative units in NACEST	40	31	0	6	3	4.2	Agree
2.	Compared to the traditional filing system, how effective is the DBMS in preventing multiple records of the same information within NACEST's administrative processes	29	40	2	5	4	4.0	Agree
3	To what extent does the DBMS improve data consistency by eliminating duplicate files previously common in the manual filing system	27	35	8	6	4	3.9	Agree
4	How would you rate the ability of the DBMS to centralize administrative records and reduce redundant data entry compared to the traditional filing system	30	42	0	4	4	4.1	Agree
5.	To what extent has the adoption of the DBMS minimized errors associated with duplicate records in NACEST's administrative operations	35	28	2	9	6	3.9	Agree
	Grand Mean						**4.0**	

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$$Grand\ Mean = \frac{\Sigma fx}{N} = \frac{20.1}{5} = 4.0$$

Table 4 with Grand Mean of 4.0 shows respondents agreed on the: Ascertain whether a database system will be more helpful than a traditional filing system in preventing data duplication.

Research Question 2: How does the implementation of a DBMS improve the speed and reliability of data access for NACEST's information system, and what is the comparative impact on data security rates between a DBMS and a standard filing system?

Table 5: Ascertain whether a database system will make data easier to access for the college's information system and how a standard filing system influences the data security rate in NACEST.

S/N	STATEMENT	SA	A	UD	D	SD	Mean $\bar{X}$	Remark
6.	To what extent has the implementation of a DBMS improved the speed of retrieving administrative records compared to the traditional filing system at NACEST	32	39	0	5	4	4.1	Agree
7.	How reliable is data access using the DBMS in terms of accuracy and availability when compared to the manual filing system	25	40	5	8	2	3.9	Agree
8.	To what extent does the DBMS reduce delays and downtime in accessing information within NACEST's information system	38	34	2	3	3	4.3	Agree
9.	How effective is the DBMS in protecting sensitive administrative data against loss, unauthorized access, or damage compared to the traditional filing system	29	41	0	8	2	4.0	Agree
10.	Compared to the standard filing system, to what extent has the DBMS improved overall data security and confidentiality in NACEST	27	38	6	4	5	3.9	Agree
	Grand Mean						**4.0**	

$$Grand\ Mean = \frac{\Sigma fx}{N} = \frac{20.2}{5} = 4.0$$

Table 5 with grand mean of 4.0 shows respondents agreed on the Ascertain whether a database system will make data easier to access for the college's information system and how a standard filing system influences the data security rate in NACEST.

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Research Question 3: What impact does the use of a standard filing system have on the ability of NACEST's college information system to enforce consistent data entry and reporting standards?

Table 6: Evaluate the impact that a standard filing system has on the college's information system's ability to enforce data standards.

S/N	STATEMENT	SA	A	UD	D	SD	Mean $\bar{X}$	Remark
11.	To what extent does the standard filing system affect consistency in data entry across different departments within NACEST	23	45	5	7	0	4.0	Agree
12.	How often does the standard filing system lead to variations in the format or content of administrative records in NACEST	38	32	0	8	2	4.2	Strongly Agree
13.	To what extent does the use of a standard filing system make it difficult to enforce uniform reporting standards across the college information system	40	30	1	9	0	4.2	Agree
14.	How effective is the standard filing system in supporting accurate and consistent generation of administrative reports at NACEST	20	35	10	10	5	3.6	Agree
15.	To what extent does the standard filing system contribute to inconsistencies or errors in institutional data reporting within NACEST	42	28	2	5	3	4.2	Strongly Agree
	Grand Mean						**4.0**	

$$Grand\ Mean = \frac{\Sigma fx}{N} = \frac{20.2}{5} = 4.0$$

Table 6 with grand mean of 4.0 shows that respondents depicts their opinion on the Evaluate the impact that a standard filing system has on the college's information system's ability to enforce data standards.

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Research Question 4: Does the adoption of a Database Management System (DBMS) shorten the duration of the student application and clearance processes at NACEST Makurdi?

Table 7: Determine whether using a database management system (DBMS) will shorten the application process.

S/N	STATEMENT	SA	A	UD	D	SD	Mean $\bar{X}$	Remark
16.	To what extent has the adoption of a DBMS reduced the time required to process student applications at NACEST Makurdi	38	32	0	7	3	4.1	Agree
17.	How effective is the DBMS in speeding up student clearance procedures compared to the previous manual process	33	40	3	4	0	4.2	Agree
18.	To what extent has the DBMS minimized delays encountered during student application and clearance processes	26	39	2	8	5	3.9	Strongly Agree
19.	How would you rate the overall efficiency of student application and clearance operations since the implementation of the DBMS	33	35	0	7	5	4.0	Agree
20.	To what extent has the use of a DBMS improved coordination between departments involved in student application and clearance processes at NACEST Makurdi	40	25	5	7	3	4.1	Strongly Agree
	Grand Mean						**4.0**	

$$Grand\ Mean = \frac{\Sigma fx}{N} = \frac{20.3}{5} = 4.0$$

Table 7 with grand mean of 4.0 shows that respondents depict their opinion on the ways that determine whether using a database management system (DBMS) will shorten the application process.

4.3 Major Findings

1. The major findings from Table 4 reveal that the implementation of a Database Management System (DBMS) has significantly reduced data duplication within NACEST's administrative processes when compared to the traditional filing system. Respondents agreed that the DBMS minimizes the repetition of the same data across different administrative units, prevents the creation of multiple records for the same information, and improves overall data consistency by eliminating duplicate files that were common under the manual

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system. The findings also show that the DBMS effectively centralizes administrative records, thereby reducing redundant data entry across departments, and minimizes errors associated with duplicate records. The grand mean score of 4.0 confirms a general consensus among respondents that the DBMS is more effective than the traditional filing system in preventing data duplication within NACEST.

2. The major findings from Table 5 indicate that the implementation of a Database Management System (DBMS) has significantly improved the speed, reliability, and security of data access within NACEST's information system. Respondents agreed that the DBMS enhances the speed of retrieving administrative records, reduces delays and downtime, and ensures more reliable access in terms of accuracy and availability compared to the traditional filing system. Additionally, the DBMS was perceived to provide better protection for sensitive administrative data against loss, unauthorized access, and damage, thereby improving overall data security and confidentiality relative to the standard filing system. The grand mean score of 4.0 reflects a consensus among respondents that the DBMS makes data access easier and more secure than the manual filing system.

3. The major findings from Table 6 indicate that the use of a standard filing system negatively impacts NACEST's ability to enforce consistent data entry and reporting standards. Respondents agreed that the manual filing system affects consistency across departments, leads to variations in the format or content of administrative records, and makes it difficult to enforce uniform reporting standards. Additionally, the standard filing system was perceived to be less effective in supporting accurate and consistent generation of administrative reports and contributes to errors and inconsistencies in institutional data reporting. The grand mean of 4.0 reflects a general consensus among respondents that the standard filing system limits the college information system's effectiveness in maintaining data standards.

4. The major findings from Table 7 indicate that the adoption of a Database Management System (DBMS) has significantly shortened the duration of student application and clearance processes at NACEST Makurdi. Respondents agreed that the DBMS reduces the time required to process student applications, speeds up clearance procedures, and minimizes delays encountered during these processes. Additionally, the system improves overall efficiency and enhances coordination between departments involved in student application and clearance operations. The grand mean of 4.0 reflects a general consensus among respondents that the DBMS has positively impacted the speed, efficiency, and coordination of student administrative processes compared to the previous manual system.

4.4 Discussion of Findings

Table 4 reveals that the use of a Database Management System significantly reduces data duplication within NACEST's administrative processes. All five questionnaire items recorded mean scores ranging from 3.9 to 4.2, with a grand mean of 4.0, indicating general agreement among respondents. This suggests that the DBMS has improved data consistency by centralizing records, reducing redundant data entry, and minimizing errors associated with duplicate records. Compared to the traditional filing system, the DBMS provides a more reliable mechanism for maintaining a single, accurate version of administrative data across departments.

Table 5 shows that respondents agreed that the implementation of a DBMS has enhanced both the speed and reliability of data access in NACEST. Mean scores ranged between 3.9 and 4.3, with a grand mean of 4.0, indicating a high level of agreement. Respondents

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acknowledged faster retrieval of records, reduced delays, and improved availability of accurate data. Additionally, the DBMS was perceived to provide better data security and confidentiality compared to the traditional filing system, reducing risks of unauthorized access, data loss, and physical damage to records.

Table 6, respondents agreed that the standard filing system negatively affects the enforcement of consistent data entry and reporting standards. Mean values ranged from 3.6 to 4.2, with a grand mean of 4.0. The findings indicate that manual filing leads to variations in record formats, inconsistencies across departments, and increased reporting errors. Although the standard filing system supports basic record keeping, it lacks the structure and validation mechanisms required to enforce uniform data standards within the college's information system.

Table 7 indicates that the adoption of a DBMS has significantly shortened the duration of student application and clearance processes at NACEST Makurdi. All items recorded mean scores between 3.9 and 4.2, with a grand mean of 4.0, showing agreement among respondents. The DBMS improved processing speed, minimized delays, enhanced inter-departmental coordination, and increased overall efficiency of student-related administrative operations compared to the manual system.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The study revealed several key findings regarding the impact of a Database Management System (DBMS) on NACEST's administrative and academic processes. First, the implementation of a DBMS significantly reduces data duplication across administrative units by centralizing records, minimizing redundant entries, and improving overall data consistency. Second, the DBMS enhances the speed and reliability of data access, allowing for faster retrieval of records, reduced delays, and improved accuracy, while also providing better data security and confidentiality compared to the traditional filing system. Third, the use of a standard filing system was found to negatively affect the enforcement of consistent data entry and reporting standards, leading to variations in record formats, inconsistencies across departments, and increased reporting errors. Finally, the adoption of a DBMS has shortened the duration of student application and clearance processes at NACEST Makurdi, improving processing speed, inter-departmental coordination, and overall efficiency of student-related administrative operations. Overall, the findings indicate that a DBMS provides more effective, efficient, and secure management of administrative and academic information compared to the traditional filing system.

5.2 Conclusion

Based on the findings of this study, it can be concluded that the adoption of a Database Management System (DBMS) at NACEST has had a substantial positive impact on both administrative and academic processes. The DBMS effectively reduces data duplication, improves consistency, and centralizes records, addressing the limitations of the traditional filing system. It also enhances the speed, reliability, and security of data access, ensuring accurate and timely information while protecting sensitive administrative records. In contrast, the standard filing system was shown to contribute to inconsistencies, errors, and inefficiencies in data entry and reporting. Furthermore, the implementation of a DBMS has streamlined student application and clearance processes, promoting better coordination among departments and increasing operational efficiency. Overall, the study demonstrates

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that a DBMS provides a more efficient, reliable, and secure framework for managing institutional information, making it an essential tool for improving the effectiveness of college administrative systems.

5.3 Recommendations

i. College staff should receive continuous training on the effective use of the DBMS to enhance their skills in data management, improve efficiency, and reduce errors associated with system misuse or lack of expertise.
ii. Regular updates and maintenance of the DBMS should be carried out to ensure optimal performance, enhance security features, and accommodate evolving administrative and academic needs.
iii. The DBMS should be integrated with all student-related processes, including applications, registrations, and clearance, to further streamline operations, reduce processing time, and improve inter-departmental coordination.
iv. NACEST should gradually reduce reliance on the standard filing system to minimize inconsistencies, errors, and inefficiencies, ensuring that all critical administrative information is managed digitally through the DBMS.
v. Policies and procedures should be established to safeguard sensitive institutional data within the DBMS, including access controls, regular backups, and monitoring of potential security threats.
vi. The institution should periodically evaluate the DBMS's impact on administrative efficiency, data accuracy, and security to identify areas for improvement and ensure sustained benefits.

5.4 Suggestions for Studies

i. Future research could examine the impact of Database Management Systems (DBMS) on administrative efficiency in other higher education institutions in Nigeria to determine whether similar benefits and challenges exist.
ii. Researchers could conduct longitudinal studies to assess the long-term effects of DBMS implementation on data management, administrative efficiency, and student services over multiple academic years.
iii. Further studies could compare the effectiveness of different DBMS software solutions in terms of speed, reliability, security, and ease of use within academic institutions.
iv. Future research could investigate how DBMS implementation influences strategic decision-making and policy formulation in educational institutions, particularly through improved access to accurate data.
v. Researchers could examine the economic implications of DBMS adoption, analyzing the cost of implementation, maintenance, and training versus the benefits gained in operational efficiency and data security.
vi. Studies could explore how DBMS can be integrated with emerging technologies such as cloud computing, artificial intelligence, and mobile applications to further enhance administrative efficiency and service delivery in colleges.
vii. Further research could focus on user satisfaction, challenges in adoption, and resistance among staff to fully understand the human factors affecting successful DBMS implementation.

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