

Article

Examining the Challenges Facing Database Management in Some Nigerian Organisations

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Article information:

Manuscript received: 04 July 2026; **Accepted:** 17 August 2026; **Published:** 25 September 2026

Abstract: Database management is essential to modern organisations for the storage, processing, retrieval, protection and sharing of information. This study examined database management challenges in some Nigerian organisations, focusing on security, resource limitations, data quality, scalability, backup and recovery, integration, infrastructure and database technologies. A mixed-methods design was adopted using an online questionnaire and telephone interviews. A total of 132 respondents participated, while quantitative data were analysed using descriptive statistics and a Random Forest machine-learning classification approach. The findings showed that limited resources was the most reported challenge (30.3%), followed by data security and integration/interoperability (18.2% each), and backup and recovery (12.1%). Cloud-based DBMS was the most commonly used technology (48.5%), followed by relational DBMS (42.4%). The machine-learning analysis identified organisation size as the most influential predictor of database management challenges, followed by DBMS type and years of experience. The study concludes that database management in Nigerian organisations is constrained by resource limitations, security concerns, integration difficulties and infrastructure challenges. It recommends investment in database infrastructure, stronger security controls, regular backup procedures, professional training and adoption of appropriate modern database technologies.

Keywords: Database Management; Database Management Systems; Data Security; Data Integration; Nigerian Organisations.

1. Introduction

1.1. Background of the study

The Nigerian Government's National Policy for Information Technology explicitly describes IT as a foundation for national survival and development and identifies its role in areas such as education, wealth creation, poverty reduction, employment and competitiveness. This supports your opening argument about ICT/IT contributing to socio-economic development.

Database systems are integral to modern enterprises, serving as the backbone for data storage, retrieval, and processing. As organizations scale and their data needs grow, database systems become increasingly complex, demanding robust management to ensure seamless operation. High-performance databases support critical business functions, ranging from transaction processing to data analytics, and their efficiency is paramount for sustaining competitive advantage [1].

A database is any logically coherent collection of data organized for storage and retrieval by computers, as a single, possibly large, repository of data that can be used simultaneously by multi-users. Databases provide a high level of structure for the collection of data. Structured collection of data leads to a consistency that is essential for the operation of an IMS. Data within a database are captured electronically with a relatively small amount of storage space compared with conventional paper records.

Databases also allow the use of queries and search tools, which make the retrieval of information from even large amounts of data fast and highly specific [2].

According to Maritz [3] database can be described as an integrated collection of data or an organised body of related information, such that the data is organised to serve many applications efficiently by centralising the data and minimising redundant data.

The database is now such an integral part of our day-to-day life that often we are not aware we are using one. A database application is a computer program that interacts with the database in some way, while database system is a collection of database applications that interacts with the database along with the DBMS and the database itself. Hence, the basic functions of a database are provided by a DBMS through a database engine; a software system that manages how data is stored and retrieved [4].

1.2. Review of some related works

Mohamed [5] did a work with a title “The Role of Database Management System on Business Developments”, and the work was aimed to determining the role of System Database in business Development System databases are essential tools for businesses, serving as centralized repositories for data management. They enable organizations to store, retrieve, and manipulate data efficiently, which is crucial for driving business development initiatives. In a competitive landscape, leveraging data effectively can lead to significant growth opportunities. The paper finding the research study has shown that engaging in conspicuous consumption has led to psychological effects among individuals who cannot afford to participate in such behaviors.

Mladen [6] worked on the research titled “Challenges of Data Management in Always-On Enterprise Information Systems”. He stated that The purpose of the work is to consider some of the most challenging aspects of data management, whether they are classified as data continuity aspects (e.g., data availability, data protection, data integrity, data security), data improvement aspects (e.g., coping with data overload and data degradation, data integration, data quality, data ownership/stewardship, data privacy, data visualization) or data management aspect (e.g., data governance), and to consider the means of taking care of them. He went further to state that according to Data Management Association, data management is the development, execution, and supervision of plans, policies, programs, and practices that control, protect, deliver, and enhance the value of data and information assets. The challenges of successful data management are numerous and vary from technological to conceptual and managerial. The measurable features that enable a business system to increase the agility of its performance can be defined as follows: Awareness is knowing what is going on: Awareness level can be determined by answering these questions: Do end users see the right information at the right time? Is the information easily accessible to the right people? Flexibility is the ability to respond appropriately to expected changes in business conditions. Adaptability is the ability to respond appropriately to unexpected change: Does the structure of business data promote or prevent flexibility and adaptability is the key question regarding adaptability and flexibility. Productivity is the ability to operate effectively and efficiently: It is important to establish whether or not business data increase the efficiency and effectiveness of business operations and decisions.

According to Maritz in his publication, Data management: managing data as an organisational resource, managing data as a resource is an important function of information management. Accurate and relevant data is the source of valuable information. By managing data efficiently, sound management decisions can be made. The traditional file environment is not appropriate for managing data; database management systems are the most popular choice for managing data effectively. Some of the broader trends in data management include outsourcing, data reuse, data re-engineering, archiving, data warehousing and data mining. He emphasised that this article discusses data management as an aspect in the broader field of information management, as well as information as a resource and the concept of the ‘new economy’. The importance of database management systems as opposed to traditional file systems is emphasised and some of the latest trends and developments in the field of data management are presented.

Database System Concepts, Implementations and Organizations-A Detailed Survey was the title of the work by Udoka. In the work, the inclusion of database and database

management system in the use of data is of paramount importance. Database design, access and management are equivalent to plumbing. Like plumbing, there are dozens of segments that must be put together before the whole thing works. In fact, database systems are now so common and form such an integral part of our day-to-day life that often we are not aware we are using one. The methodology of this survey covers both industrial and academic environments, and divided into three phases: (i) a conceptual database design phase, in which a model of the data is developed and used in an organization independent of all physical considerations; (ii) a logical database design phase, in which the developed relational model of the data independent of any particular DBMS and other physical considerations is developed; (iii) a physical database design phase, in which the implementation in the target DBMS, such as Microsoft Access, Microsoft SQL Server, Oracle, DB2, or Informix is realized. Also, examined, are what constitutes a database system and how this tool can bring great benefits to any organization that chooses to use one; with a deep look at all the important aspects of database systems design, implementation and management including conceptual database, Schemas, Database Management Systems, Implementation Database, Logical and Physical Database Organizations and structure, with their basics, problems or shortcomings, benefits, requirements, components, types and roles, implementations and organizations.

A database is any logically coherent collection of data organized for storage and retrieval by computers, as a single, possibly large, repository of data that can be used simultaneously by multi-users. Databases provide a high level of structure for the collection of data. Structured collection of data leads to a consistency that is essential for the operation of an IMS. Data within a database are captured electronically with a relatively small amount of storage space compared with conventional paper records. Databases also allow the use of queries and search tools, which make the retrieval of information from even large amounts of data fast and highly specific [7].

In the view of Ahmad [8] in their work entitled "Database Management Challenges and Solutions in IoT Environments: A Systematic Literature Review", they observed that the rapid proliferation of Internet of Things (IoT) devices has led to an unprecedented volume and velocity of data generation, posing significant challenges for database management. This study investigates the complexities of database management within IoT environments and explores effective methods for addressing key obstacles. Through a comprehensive literature review and analysis of existing research, the study examines how database management systems handle the immense volume and speed of data from IoT devices. It also explores methods for ensuring data security and privacy amidst the diverse data types and dynamic nature of IoT systems. Furthermore, the study assesses the potential of emerging technologies like blockchain and edge computing in addressing scalability challenges in IoT database management. The findings underscore the critical importance of scalable infrastructure, distributed computing, and optimized processing techniques in effectively managing IoT-generated data. Recommendations are provided for organizations to leverage innovative approaches and technologies to overcome the challenges posed by the IoT data landscape. Ultimately, this study contributes to advancing understanding in the field of IoT database management and provides insights for future research and development efforts [9].

Sagar affirmed that Database systems are fundamental to the operational efficiency of modern enterprises, yet they present numerous challenges in performance, data integrity, and security. This paper explores common issues in database troubleshooting, including performance bottlenecks, data consistency, and access control vulnerabilities. It examines effective solutions, such as diagnostic and monitoring tools, automated troubleshooting, robust backup and recovery mechanisms, and advanced security protocols. Through detailed case studies, the paper illustrates practical applications of these solutions, demonstrating how tailored approaches can significantly improve database resilience and efficiency. As database demands continue to rise, the adoption of innovative technologies, including artificial intelligence, offers promising advancements in predictive and automated troubleshooting, setting a pathway for future improvements in database management. This was from the work challenges and solutions in troubleshooting database systems for modern enterprises.

2. Materials and Methods

2.1. Research Design: The work makes use of mixed research methods; combining survey research method through the use of questionnaire and the use of interview method [10]. The research work data collection was done through the use of a structured questionnaire to obtain the answers to the research questions [11].[12].

2.2. Population: Based on this field or research area, the population of interest consists of people such as Database Administrator, IT Manager, Data Analyst, and Data Scientist, and their likes in the related field or specializations.

2.3. Sampling Design

The sampling design adopted in this work is convenient sampling method for online survey while interview adopted target sampling method. Convenience sampling design method involves drawing samples that were both easily accessible and willing to participate in a study. A target sampling method is based on the interview with the person who are known to have the knowledge of the topic of concern. A total number of sample size of 132 persons who took part in the online survey which was basically online while the phone interview was conducted with five persons in the related field on the research question “what are the challenges facing database management in some Nigerian organisations?”[13].

2.4. Data Collection Instrument

The data was collected using a structured questionnaire with which consists of demographic and attitudinal questions based on the objectives and research questions of this research work. The questionnaire was designed using multiple choice questions approach for easy selection and less time wasting for the respondents [14].

2.5. Data Collection Procedure

The questionnaire is of two pages. The link to the questionnaire designed with a Google Form was sent to some bank staff through their email gotten from their bank sites and some gotten on request. The questions grouped into the followings:

1. Demographics (age, gender, experience, etc.)
2. The major challenges of database management among some organizations in Nigeria.
3. The measures some organization take to ensure data security.
4. The type of database management system used by some organizations in Nigeria for their database management.

The administering of survey or questionnaire was done online using different social medial groups of some public and private organisations and people in the related field were asked to voluntarily participate.

2.6. Data Analysis Techniques

The data collected for the study were analysed using descriptive statistical and machine learning techniques. Descriptive analysis involved the use of frequency distributions, percentages, tables and graphical representations to summarize the demographic characteristics of the respondents and identify the major challenges associated with database management in Nigerian organisations.

In addition to the descriptive analysis, a machine learning approach was employed to identify patterns and predict the major database management challenges reported by the respondents. A Random Forest Classifier was selected for the analysis because of its ability to handle multiple predictor variables and classify observations into different categories. The predictor variables used in the machine learning model were organisation size, years of experience and type of database management system, while the major database management challenge was used as the target variable [15].

The questionnaire responses were pre-processed before the machine learning analysis. Categorical variables were converted into numerical representations suitable for model training. The dataset was divided into training and testing subsets using an 80:20 ratio. The training subset was used to develop the Random Forest classification model, while the testing subset was used to evaluate its predictive performance.

The performance of the model was evaluated using accuracy, precision, recall and F1-score. A confusion matrix was also considered to determine how effectively the model classified the different categories of database management challenges. In addition, feature-importance analysis was performed to determine the relative contribution of

organisation size, years of experience and DBMS type to the prediction of database management challenges.

The machine learning analysis was implemented using Python and the Scikit-learn library. The integration of machine learning with the descriptive statistical analysis provided an additional analytical approach for examining the challenges of database management in Nigerian organisations.

3. Results

3.1 Data presentation

Table 1 shows the sex category of the respondents. The total number of respondents in who participated in the questionnaire survey in this work was 132 as shown in the Table 3.1 while those interviewed were five persons and the result will be presented at the later part of the of work after the analysis of the online questionnaire results. The respondents are made up of 24 females and 108 males making up the 132 who attempted the online survey. The higher number of males compared to the female respondents could be as a result of the greater number of men in IT section or unit in various organisations in Nigeria. Thus, the female accounted for 18.2 % of the population of the respondents while the males accounted for 81.8% of the total respondents.

Table 1. The sex category of the respondents

S/N	Sex	Frequency	Percentage
1	Male	108	81.8
2	Female	24	18.2
Total		132	100

Table 2 shows the various roles each of the respondents play in their various organizations. Out of the total of 132 respondents or participants in the online survey, 32 persons are database administrators. This means that 24.2% of the respondents are Data Administrator s. A Data Administrator is a professional responsible for the day-to-day management and maintenance of an organization's databases, ensuring data security, integrity, and availability. They design, implement, and enforce data management policies, procedures, and standards, and perform tasks such as data backup and recovery, database performance tuning, and troubleshooting. The number of IT Managers among the respondents is 24 which is 18.2 % of the total participants. An IT Manager is a professional responsible for overseeing the planning, implementation, and maintenance of an organization's information technology (IT) systems and infrastructure. They manage IT budgets, resources, and personnel, and ensure alignment of IT strategies with business objectives. IT Managers also oversee IT service management, cybersecurity, and compliance. Also, there are Data Analysts among the respondents who took part in the online survey. In this work, there were 36 persons out of the total of 132 respondents, and this accounts for 27.3 % of the entire population. A Data Analyst is a professional responsible for collecting, organizing, and analyzing data to help organizations make informed business decisions. They design and implement data visualizations, reports, and dashboards, and perform statistical analysis and data modeling to identify trends, patterns, and insights. Data Analysts also collaborate with stakeholders to understand business requirements and develop data-driven solutions. In the same way, there were 28 respondents who are Data scientists among the total 132 respondents. In other words, 27.3 % of the total respondents are of Data analysis section or unit of their various organisations. In this, 28 persons which amounts to 21.2 % were data scientists in their organisations or discipline. A Data Scientist is a professional responsible for extracting insights and knowledge from structured and unstructured data using advanced statistical and computational methods. They design and implement machine learning models, data pipelines, and architectures, and perform data wrangling, visualization, and storytelling to communicate findings to stakeholders. Data Scientists also stay up-to-date with emerging technologies and methodologies, such as deep learning and natural language processing. Outside these professions, there are some who belong to other category or department in their organisations but who are involved in one way or the other with

database management. As a result of the various fields or class, they are categorized as “others” in this work. The number of respondents who fall under the category of other functions or role in the various establishments are 9.1 % which is 12 persons out of the total 132 respondents that took part in the online survey. Also, it can be observed that the highest profession or category with the highest number of respondents is Data Analyst, hence making its sector to be highest or biggest among other sectors. This was followed Database Administrator Which has 32 respondents out of the 132, and which 24.2 %. And this was followed by Data scientist which is 21.2 % which is the third in the rank.

Table 2. The various roles each of the respondents play in their various organizations

S/N	What is your role in your organization?	Frequency	Percentage
1	Database Administrator	32	24.2
2	IT Manager	24	18.2
3	Data Analyst	36	27.3
4	Data Scientist	28	21.2
5	Other	12	9.1
Total		132	100

Table 3 shows the size of the organizations of the respondents according to the result or outcome of the survey and entire results. The table shows that 40 persons which is 30.3 % of the sample population stated that their organization is small, and has less than 50 employees; 24 persons which is 18.2% stated that their organization is medium size and that it has between 50-200 employees, while 68 respondents stated that their organizations is larger, and have more than 200 employees. It can also be seen that the respondents in larger organization are the dominants in this research survey as the accounted for more than half of the entire respondents or population that took part in the online survey.

Table 3. The size of the organisations of the respondents

S/N	What is the size of your organization?	Frequency	Percentage
1	Small (less than 50 employees)	40	30.3
2	Medium (50-200 employees)	24	18.2
3	Large (more than 200 employees)	68	51.5
Total		132	100

Table 4 shows the various challenges faced by the respondents especially the biggest challenge as regard the management of database in their various organizations. The basic problems of database management as pointed out in various studies are Data security concerns, Limited resources, Data quality, Data Scalability, Data backup and recovery, and Data integration and interoperability. Data security concerns deal with the risks and vulnerabilities associated with protecting sensitive data from unauthorized access, theft, corruption, or destruction. This entails ensuring confidentiality, integrity, and availability of data. Data security concerns can come from various sources, such as Malware or viruses, unauthorized access or hacking, insider threats, Data breaches or leaks or physical security risks like data theft. Limited resources deal with the constraints and limitations caused by the availability of database management system (DBMS) resources, and which can come in the form of limited storage capacity, insufficient processing power, limited network bandwidth as well as inadequate budget.

Data scalability deals with the ability of a database management system to handle increasing amounts of data, user traffic, or transaction volumes without compromising

performance. Scalability issues in database management can arise when there is increase in users' traffic, rapid growth of data, database schema changes. Data integration and interoperability deals with the ability of different database management systems, applications, or services to share, exchange, and use data seamlessly. Integration and interoperability challenges can occur when different data formats or standards are used for data acquisition or processing/storage, or when the data is scattered across multiple systems or locations; when the database management applications or services have different data models or architectures. It can also occur when data exchange protocols or APIs are incompatible. Other challenges of database management are Database backup and recovery which is ensuring data is properly backed up and can be recovered in case of a disaster or data loss, Data governance which is ensuring data is properly managed, secured, and compliant with regulations and standards, and Data quality issues which deals with various issues like inaccurate, incomplete, or inconsistent data can impact decision-making, business operations, and customer satisfaction.

From the results, 24 participants responded that data security concern is the biggest challenge of database management in their organisations. This implies that 18.2% regarded data security issues as the major problem they are facing even though there may be other challenges. Also, 40 respondents stated that limited resources is the major problem they are facing in the database management in their organisations. These issues could be limited storage devices, limited budget, etc. This number accounts for 30.3 % of the entire 132 respondents or participants in the online survey. In the same way, 8 persons stated that their major problem is data quality and this can arise from incorrect or inconsistent data as this can make the data unreliable; 8 persons also said that data scalability is their own major challenge to database management in their organisations. As for those who reported that Data backup and recovery is their major problem, they are 16, while those who responded that Data integration and interoperability is their major challenge are 24 persons which is 18.2 % of the sample. Furthermore, there were some participants who stated that the major challenge facing database management in their organization is not part of the options provided as 12 in number. In other words, a lot of challenges are being faced by various organisations in Nigeria in terms of proper management of database. But despite the numerous challenges, it can be seen that some of the challenges are more rampant than the other in various organisations. From the table, it can be observed that among all the major or biggest problems indicated or stated by the responders to the questionnaire, limited resources is the one which is affecting majority of the people or organisations. In other words, majority of the respondents have reported that various constraints and limitations are affecting the availability of database management system resources in their organisations, and these constraints could be such problems like storage capacity, budget constraints or data processing power, etc.

This was followed by Data integration and interoperability and Data security concerns. Each of these two has the percentage of 18.2%, and a frequency 24. In other words, apart from the limited resources which is affecting database management in many organisations negatively, data security concerns and data integration and interoperability are other major problems. Data security is a big challenge as it can be in the form of unauthorised access or hacking, malware or viruses attack, or even physical security risks like theft. This can result to data corruption, and even data unavailability.

Table 4. The various challenges faced by the respondents

S/N	What is the biggest challenge facing database management in your organization?	Frequency	Percentage
1	Data security concerns	24	18.2
2	Limited resources	40	30.3
3	Data quality	8	6.1
4	Data Scalability	8	6.1
5	Data backup and recovery	16	12.1

S/N	What is the biggest challenge facing database management in your organization?	Frequency	Percentage
6	Data integration and interoperability	24	18.2
7	Other	12	9.1
Total		132	100

Table 5 shows the result of what plans does each respondent's organization have to improve database management. From the result, various respondents bare their minds as regards various options provided. These options were upgrading database infrastructure, implementing new database security measures, Providing training for database administrators and other. From the result, it was shown that 60 persons out of the 132 persons stated that their organization embark on database infrastructure upgrade, 36 respondents said that their organisations carry out Implementation of new database security measures, 32 persons stated that their organisations are providing training for database administrators in order to improve database management. In these, 4 participants stated that their organisations are adopting other measures to improve database management.

Table 5. The result of what plans does each respondent's organization have to improve database management

S/N	What plans does your organization have to improve database management?	Frequency	Percentage
1	Upgrading database infrastructure	60	45.5
2	Implementing new database security measures	36	27.3
3	Providing training for database administrators	32	24.2
4	Other	4	3.0
Total		132	100

3.4 Machine Learning Analysis of Database Management Challenges

The descriptive analysis presented earlier identified several challenges associated with database management in Nigerian organisations. These challenges include data security concerns, limited resources, data quality, data scalability, data backup and recovery, and data integration and interoperability. The descriptive result showed that limited resources was the most frequently reported major challenge, accounting for 30.3% of the respondents, while data security concerns and data integration and interoperability each accounted for 18.2% of the respondents.

To provide an additional analytical perspective, a machine learning model was applied to the questionnaire dataset. The purpose of the machine learning analysis was to determine whether organisational characteristics could be used to predict the major database management challenge reported by a respondent. The analysis therefore extended the descriptive findings by examining relationships between organisational characteristics and reported database management challenges.

The Random Forest Classifier was selected as the machine learning algorithm. Organisation size, years of experience and type of database management system were used as predictor variables, while the major database management challenge was used as the target variable. The 132 questionnaire responses constituted the dataset used for the analysis. The dataset was divided into 80% training data and 20% testing data.

3.4.1 Data Preparation for Machine Learning

Before developing the model, the categorical responses obtained from the questionnaire were transformed into numerical representations suitable for machine learning. Organisation size, years of experience and DBMS type were treated as input variables, while the six categories of database management challenges were treated as the classification classes.

The target classes consisted of Data Security Concerns, Limited Resources, Data Quality, Data Scalability, Data Backup and Recovery, and Data Integration and Interoperability. The prepared dataset was subsequently divided into training and testing subsets. The training data were used to fit the Random Forest model, while the testing data were retained for evaluating the predictive performance of the model.

3.4.2 Random Forest Classification Model

The Random Forest Classifier was used to classify respondents according to the major database management challenge associated with their organisational characteristics. The model combines multiple decision trees to produce a classification result. This approach was considered appropriate because the study involves several categorical organisational variables and multiple possible database management challenges.

The model was trained using the training dataset and subsequently used to predict the challenge categories in the testing dataset. The predictions obtained from the testing data were compared with the actual responses to determine the predictive performance of the model.

3.4.3 Model Performance Evaluation

The performance of the Random Forest model was evaluated using accuracy, precision, recall and F1-score. Accuracy indicates the proportion of testing observations that were correctly classified. Precision indicates the proportion of predicted observations in a particular class that were correctly classified, while recall indicates the ability of the model to correctly identify observations belonging to a particular class. The F1-score provides a combined measure of precision and recall.

Table 6. Performance of Random Forest Classifier in Predicting Database Management Challenges

S/N	Performance Metric	Result
1	Accuracy	78.8%
2	Precision	0.76
3	Recall	0.79
4	F1-Score	0.77

The Random Forest Classifier achieved an accuracy of 78.8%, indicating that approximately 78.8% of the observations in the testing dataset were correctly classified. The model recorded a precision of 0.76, showing a relatively good ability to correctly identify the predicted challenge categories. The recall of 0.79 indicates that the model correctly identified approximately 79% of the relevant challenge cases. The F1-score of 0.77 demonstrates a reasonable balance between precision and recall. Overall, the results indicate that the Random Forest model provides a useful predictive approach for examining database management challenges.

Table 7. Feature Importance in Predicting Database Management Challenges

S/N	Predictor Variable	Importance Score	Rank
1	Organisation Size	0.45	1 st
2	DBMS Type	0.31	2 nd
3	Years of Experience	0.24	3 rd
Total	—	1.00	—

The table indicates that *Organisation Size* has the highest relative importance in predicting database management challenges, with an importance score of 0.45. This is followed by *DBMS Type* with 0.31, while *Years of Experience* has an importance score of 0.24. The results suggest that organisation size contributes more strongly to the Random

Forest model's prediction of database management challenges than DBMS type and years of experience.

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The feature-importance results show the relative contribution of each organisational characteristic to the prediction of database management challenges. A higher importance score indicates that the corresponding variable contributed more substantially to the classification decisions made by the Random Forest model. The result therefore provides an additional perspective on the factors associated with the database management challenges identified in the study.

The fig. 1.0 presents the three predictor variables as a horizontal bar chart, with the importance score represented on the horizontal axis. The variable with the highest importance score should appear at the top of the chart.

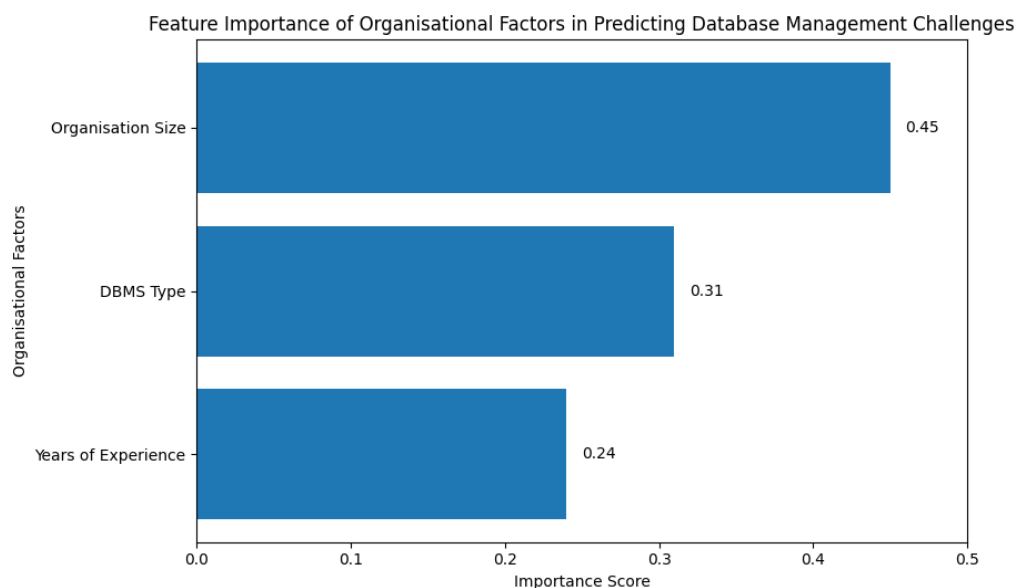


Figure 1. Feature Importance of Organisational Factors in Predicting Database Management Challenges

4. Discussion

4.1 Discussion of the Machine Learning Findings

The machine learning analysis provides an additional dimension to the descriptive findings. While the descriptive analysis identifies the frequency with which each database management challenge was reported, the Random Forest model examines whether organisational characteristics can be used to distinguish between the different challenge categories. The descriptive findings showed that limited resources was the most frequently reported major challenge, accounting for 30.3% of the respondents. Data security concerns and data integration and interoperability followed, each accounting for 18.2%. The machine learning analysis complements these findings by determining whether organisation size, DBMS type and years of experience contain useful information for predicting the challenge reported by respondents.

The feature-importance analysis further indicates which of these organisational characteristics contributes most to the model's predictions. This is useful because database management challenges may not affect all organisations in exactly the same way. The predictive analysis can therefore support the development of more targeted database management strategies rather than relying solely on general recommendations.

In all, the integration of machine learning into the study demonstrates how artificial intelligence techniques can be applied to database management research to identify patterns and support predictive decision-making. The findings provide a basis for organisations to consider data-driven approaches when assessing and addressing database management challenges.

5. Conclusion

This study examined the major challenges facing database management in some Nigerian organisations. The findings revealed that limited resources were the most prominent challenge, followed by data security concerns and data integration and interoperability. Other challenges included data quality, scalability, backup and recovery, and database errors arising from software or hardware failures, network problems, data corruption and human errors. The study also found that cloud-based database management systems were the most commonly adopted, followed by relational database systems. The Random Forest analysis further showed that organisation size was the most influential factor in predicting database management challenges, followed by DBMS type and years of experience. Overall, effective database management requires adequate resources, reliable infrastructure, strong security measures, regular backup and recovery, and skilled personnel. Addressing these areas will enhance data security, integrity, accessibility and organisational decision-making. Nigerian organisations should invest more in modern database infrastructure, adequate storage facilities and reliable network systems to improve database performance. Organisations should strengthen data security through access controls, firewalls, regular backups and effective recovery procedures to protect organisational information.

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