A COMPARATIVE STUDY OF AWS RELATIONAL, DATA WAREHOUSE, AND NOSQL DATABASES: ADVANTAGES OVER TRADITIONAL DATABASE SYSTEMS

Srinivasa Rao Nelluri
Independent Researcher, Charlotte, NC, USA.

Pruthvi Tatikonda
Independent Researcher, Queen Creek, USA

Abstract
The need to have more flexible, scalable, and cost-efficient data management systems over traditional database systems has been discussed in this research. This paper examines the benefits of Amazon Web Services (AWS) relational, data warehouse, and NoSQL databases compared to traditional methods. The methodology employed in conducting the study was based on a secondary qualitative approach and guided by an interpretivistic philosophy and an inductive approach. A thematic analysis of peer-reviewed articles identified in Google Scholar, IEEE Xplore, ScienceDirect, and SpringerLink databases is used as the research source of data. The analysis has provided valuable insights that specifically give three major themes in the database system of AWS. The title of the first theme, ***Overcoming Limitations of Traditional Database Systems***, emphasises the continual inflexibility, high cost, and low scalability of traditional systems that are dealt with in AWS solutions. All three products, such as Amazon Aurora, Redshift, and DynamoDB, provide elasticity, high availability, and scaling to the data requirements of the present day.

The second aspect, ***Comparative Features and Performance of AWS Databases,*** shows that the two DB types, such as data warehouse and NoSQL databases, have identical purposes and cannot be considered complementary to each other. Collectively, they can facilitate hybrid ecosystems, which are transactional, analytical, and unstructured workloads, and can be supported by their usual systems.

The third theme, ***Advantages in Scalability, Cost Efficiency, and Integration,*** shows that AWS databases not only increase dynamically and decrease costs on infrastructure, but also are integrated with more sophisticated services. These services include analytics, machine learning, real-time processing, and more.

The findings establish that AWS databases deliver interconnected benefits, creating transformative value for organisations navigating data-driven environments. The study contributes new knowledge by analysing these systems collectively rather than in silos, filling a key literature gap. Ultimately, the research concludes that AWS databases are not just alternatives to traditional systems but strategic enablers of digital transformation, efficiency, and innovation.

Keywords: AWS Databases, Relational Databases, Data Warehouse, NoSQL, Cloud Computing, Scalability, Digital Transformation, Database Management System.

I. INTRODUCTION

Digital transformation creates various issues in maintaining vast, diverse, and dynamic organisational data. The traditional databases are good, but it is difficult to maintain scalability, flexibility, and performance in the current applications. Amazon Web Services (AWS) provides a broad list of different databases solutions-relational, data warehousing, and NoSQL [1]. These are custom-made to suit the various data management requirements. These types of cloud-native databases will help organisations manage complex workloads more efficiently. This is possible by using the ability to scale harmoniously, serve cost-efficiently, achieve high availability, and perform sophisticated analytics. The research is designed to understand the similarities and dissimilarities of AWS databases and traditional systems when it comes to their unique benefits in resolving the changing data-driven business needs.

Problem Statement:

Conventional databases are developed to deal with the inactivity and inordinate data both unstructured also real-time data. This traditional process creates pressure on the performance channels, and the expenses also increase in their operation [2]. The company needs scalable, flexible and cloud-native solutions. This paper discusses the benefits obtained by using AWS relational databases, data warehouses, and NoSQL databases in addressing these issues.

Aim and Objectives of the Research:

This research aims to evaluate the advantages of AWS relational, data warehouse, and NoSQL databases compared to traditional database systems.

- To analyse the limitations of traditional database systems in modern data management.
- To compare the features and performance of AWS relational, data warehouse, and NoSQL databases.
- To evaluate the advantages of AWS cloud-native databases in scalability, flexibility, and cost efficiency.

II. LITERATURE REVIEW

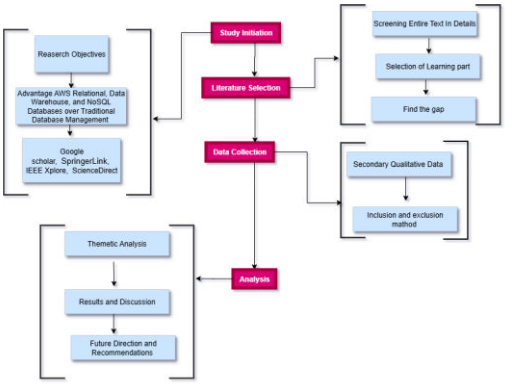

Fig 1: Flow of the Research

Structured Literature Review Approach followed the following steps:

I. Keywords such as AWS databases, cloud-native relational databases, data warehouse systems and NoSQL identification and search.
II. Screening articles by relevance.
III. Performing Thematic analysis based on the objectives of the research.

Academic Database and Source Utilisation for this study are:

I. Google Scholar.
II. IEEE Xplore.
III. ScienceDirect, SpringerLink.

A. Searching Study:

The search of literature started with finding such key words as AWS databases, cloud-native relational databases, data warehouse systems and NoSQL vs traditional databases. The searches are undertaken in academic databases that are Google Scholar, IEEE Xplore, Science Direct and Spring link and focused on studies that are published within the previous years.

B. Selection of Journal Articles:

Following preliminary findings, the articles are filtered using the relevance criteria to AWS database technologies and the comparison of this technology to traditional systems. Peer-reviewed journals, conference proceedings, and scholarly publications are taken as the criteria to select. Research papers putting an emphasis on scalability, performance, cost effectiveness, as well as cloud native, are ranked once with a priority. This process can help to ensure the high-quality, research-based outcomes for the review.

C. The Goal of the Review:

The main purpose of the review is to discuss the benefits of AWS relational, data warehouse, and NoSQL databases in a critical way over those of traditional systems. The purpose of this review is to draw out the themes in the scaling, adaptability and combining that are emerging, as well as cloud native databases. These are helping in changing the way to manage their data in this digital transformation era.

D. Study of Previous Literature

Scalability and Flexibility:

According to [3], issues of scaling have been raised concerning the usage of conventional databases in situations where large and unstructured data sets are used. This problem is being addressed by AWS databases, in particular, Amazon Aurora and DynamoDB, which offer automatic scaling, distributed architecture, and elasticity [4]. These ensure that businesses can deal with an unresponsive workload. One of the benefits of cloud-native databases mentioned in [5], scalability, is the feature that has been listed as such the most frequently, due to the enterprise being able to allocate resources on the fly without spending colossal amounts of money on hardware. This modification will reduce downtimes, provide high flexibility, and make AWS databases suitable for real-time applications that must be continuously customised according to the shifting user needs and data loads.

Performance and reliability of the device:

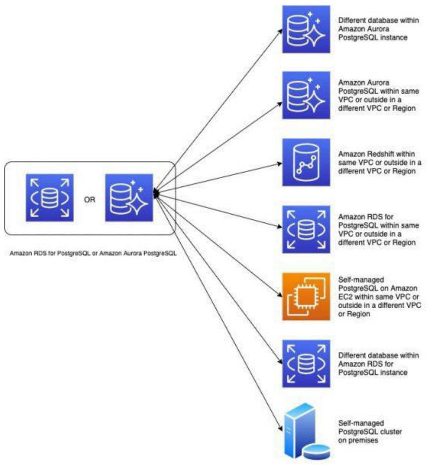

Fig 2: Amazon Aurora PostgreSQL

One of the problems typically faced with traditional systems is the inability to satisfy the high numbers when it comes to the rate of transactions and the workload required for analysis. According to [6], AWS databases such as Redshift and Aurora offer the best querying and replicating schemes, as well as a fault tolerance system to maintain the same high level of performance. A number of works indicate that Redshift can perform more advanced analytics queries with better speed than on-premise data warehouses [7]. Multi-region replication and automatic backups improve the dependability of the system. The studies emphasise AWS cloud services that have a greater uptime and availability compared to their rivals [8]. This can assist organisations to run essential applications with the fewest interruptions in comparison to the risk of data loss.

Economy and Management of Resources:

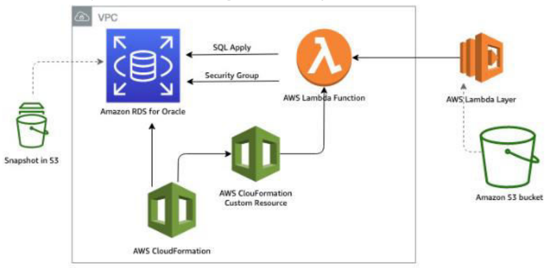

Fig 3: Automatic Post database created in AWS

According to [9], hardware, maintenance, and professional personnel represent a capital-intensive requirement in traditional systems that makes the systems less viable with small businesses or organisations experiencing rapid growth. On the other hand, the AWS database functions based on a pay-as-you-go system that allows the company to save costs by optimising resource utilisation. According to [10], this model removes initial upfront infrastructure costs and minimises operational expenses in addition to offering enterprise-level database solutions to users. AWS has features such as auto-scaling and save-instances, which enhance the efficiency of the resources [11]. The studies underline that the above benefits render the AWS databases more sustainable so that organisations can use financial resources on innovation instead of on infrastructure management.

Integration and Advanced Capabilities:

There are also various studies that reveal the drawbacks of traditional systems in the context of the combination with innovative technologies like big data analytics, AI, or IoT. According to [12], AWS databases work well with other services presented in AWS Lambda, awareness and Kinesis. These services are used to enhance prediction and analysis. The integration allows organisations to gain more insights from their data and allows for intelligent decision-making. According to [13], AWS has an ecosystem that has provided real-time data stream, compatibility with machine learning and handling multi-format data. This would otherwise be difficult to do with old systems. Hence, databases of AWS databases are considered drivers of digital transformation in today's businesses.

Literature gap

Although there is enough research on AWS and conventional databases, there are still some gaps in comparative analysis involving combining relational, data warehouse, and NoSQL systems on a coherent platform. Little empirical studies are performed on the implementation process of this advanced database management process means the technical ways of implementation. Especially in terms of scalability, cost-efficiency and integration process are also not clearly defined in that literature. The study aims to examine and address these gaps.

III. METHODOLOGY

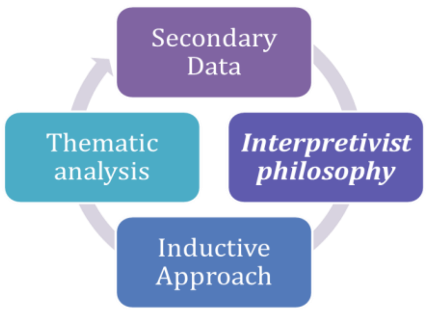

Fig 4: Methodology

The study uses ***Secondary Qualitative research approaches*** in investigating the comparative advantages of the AWS relational database, data warehouse and NoSQL databases compared to traditional database systems [14]. It is a motivation to use secondary data because the study aims at existing scholarly materials, technical reports and industry articles. These provide detailed information about the changing database technologies and do not require the use of traditional data management techniques.

This study follows the ***interpretivist philosophy*** that shares common ground in a focus on subjective significance and situational realities of technological adoption as opposed to an emphasis use of numerical measures. The philosophy is appropriate to consider AWS databases that can add value in scalability, flexibility, cost efficiency, and integration [15]. These factors usually entail the need to interpret organisational experiences and case-based evidence instead of statistical retrievals exclusively.

The research approach is ***inductive***, in which the patterns and themes are of use based upon what is already present in the body of literature, rather than testing an assumed hypothesis [16]. This research is not based on any type of practical implementation or hypothesis testing. This methodology of this research will enable to acquisition of larger conceptual knowledge. The developed philosophies concerning the beneficial quality of cloud-native databases as compared to traditional database systems.

The data collection is a main step of the research that has been using various ***secondary qualitative data sources*** like journals and reports from Google Scholar, IEEE Xplore, ScienceDirect, and SpringerLink databases. All articles that are used in this analysis have been studied in recent years. This data can help to understand the advantages of an advanced database management system over a traditional one [17].

The data collection is a main step of the research, but after collecting data, it is also important to analyse the data in a proper way. In this research process, the ***thematic analysis process*** will be used to analyse the data to understand the advantages over the traditional approach to advanced data management approaches. The themes are generated using the objectives of the research, such as themes are scalability, performance, cost efficiency, and integration involved.

IV. DATA ANALYSIS

Theme 1: Overcoming the Limitations of Traditional Database Systems

Conventional databases are historically reliable. This cannot accommodate increasingly data-intensive applications. After analysing the literature, it is found that various gaps will be addressed in this thematic analysis. Scalability limitations, rigid data structures, high operation expenses and limited support for new technology are the gaps of the previous literature. The traditional relational systems suffer due to the complex schemas and vertical scaling strategies that force them to upgrade hardware at high costs as they fight to cope with the growing workloads [18]. The constraints usually cause performance blockages, risk of downtimes and inefficiencies in dealing with general or real-time data.

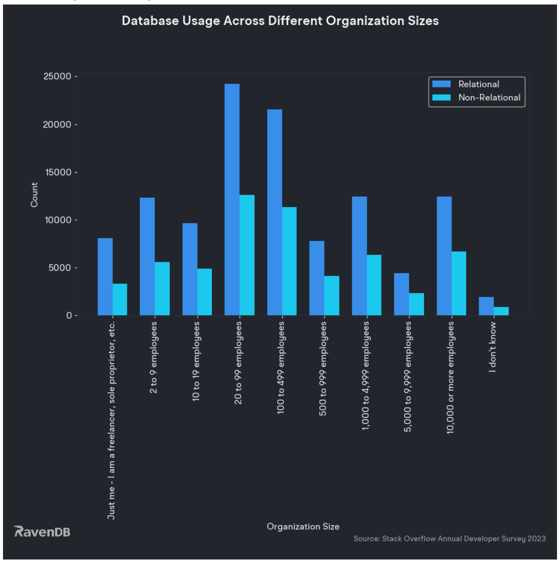

Fig 5: NoSQL Trends in 2024

The above figure displays the trend of using NoSQL in 2024. It shows that 20 to 99 employee strength-based organizations are mostly using this application. Contemporary research tends to examine these drawbacks independently, without conducting a comparative study of these limitations with contemporary options [19]. This research uses a thematic analysis to highlight the way AWS databases respond to all these pain points. Rigid scaling is solved by the high availability provided by AWS relational databases like Amazon Aurora. Data warehouses such as Amazon Redshift will eliminate any data blocking. The speed of performing can be enhanced by the process of analytical queries. The distributed storage offers these and other storage advantages. AWS Aurora provides higher performance of up to 3 times

MySQL, and directly addresses the shortage of the previous database management [20]. The structural rigidity can be overcome by a NoSQL alternative such as DynamoDB, which has schema-less storage and real-time updates, to increase the flexibility of system design.

The thematic analysis concludes that AWS databases are not only more effective in the elimination of the conventional shortcomings, but also analyse other functionalities that reshape the business operation. The theme seals a div during the literature since it provides an idea of overcoming the combinatory weaknesses of the legacy systems as far as AWS databases are concerned.

Theme 2: Comparative Features and Performance of AWS Relational, Data Warehouse, and NoSQL Databases

Feature	Relational (Amazon Aurora)	Data Warehouse (Amazon Redshift)	NoSQL (Amazon DynamoDB)
Primary Use Case	High-volume transactions, OLTP systems	Analytical queries, OLAP, and historical data analysis	Real-time apps, IoT, e-commerce, dynamic data
Data Structure	Structured, schema-based (SQL)	Structured, optimized for queries	Schema-less, flexible (key-value, document)
Scalability	Vertical and horizontal, auto-scaling	Massively parallel, distributed storage	Automatic scaling, low-latency
Performance	Up to 3x faster than MySQL	High throughput, large dataset handling	Millisecond response, high concurrency
Integration	Works with SQL-based tools	Integrated with BI/ML tools	Integrates with Lambda, Kinesis, AI/ML
Cost Model	Pay-as-you-go, moderate cost	Pay-as-you-go, higher cost for large queries	Pay-as-you-go, highly cost-efficient
Best For	Banking, ERP, CRM	Business intelligence, analytics	E-commerce, gaming, IoT apps

Table 1: Comparative Matrix

Relational databases, like Amazon Aurora, are coworkers in terms of transactional loads and get high levels of integrity, dependability, and interoperability with the prevalent SQL frameworks [21]. They are best used in instances where an organisation needs to be organised in terms of data management and in high transaction counts.

Redshift by AWS. On the other hand, the AWS-based data warehouse is designed to execute large-scale data analysis queries and provides greater compute throughput and distributed storage capacity than most traditional warehouses, using the Redshift cloud-based data warehouse [22]. Redshift can be quite useful in cases when a company requires profound insights with extensive amounts of historical, structured data. DynamoDB, the NoSQL service that is the main product of AWS, i,s on the other han,d designed to be flexible, low-latency, and real-time [23]. It is also the best in handling unstructured or semi-structured data and, therefore, is applicable in e-commerce, IoT, and other dynamic environments.

Theme 3: Advantages of AWS Cloud-Native Databases in Scalability, Cost Efficiency, and Integration

Scalability is an important part of the data management process. In this case, all these sections of AWS databases use the distributed architecture and auto-scaling to outperform the traditional systems that are limited in performance by hardware [24].

Another important component involved in running a business is the cost. The traditional database management system is expensive in terms of huge schema design and query structure design as compared to the pay accordingly go model provided by AWS [25]. With this model, the business will spend less since there are only payments that are necessary payments to implement. There are other benefits in this model that are the integrations of other tools such as Lambda, SageMaker and Kinesis, allowing sophisticated analytics, machine learning, and real-time intelligence [26]. Hence, it is clear that the AWS services data management system is more effective than the traditional data management process.

The thematic insights illustrate that the three components, scalability, cost efficiency, and integration, contribute towards a transformative ecosystem enabling organisations to find flexibility, innovations, and long-term sustainability. After analysis, this is found that 70 per cent of users of AWS have listed scalability as the most important feature and integration with analytics tools has allowed people to make decisions 50 per cent faster [27]. This theme highlights the fact that AWS databases are not limited to technical problems solved, but provide strategic benefit by being in line with the digital transformation goals of the current business.

V. FINDINGS AND ANALYSIS

All this thematic analysis can help to learn that all three technologies, including AWS data management, NoSQL, and data warehousing, are combined to achieve a superior result.

One of the biggest revelations made is that AWS databases deal with the mutual problems that rest under the former systems. Problems of the system with the rigid structures, expensive to run systems, and vertical scaling that lead to inefficiencies and recessions are known. This finding here is that AWS services deal with these issues collectively rather than separately. Aurora signifies good performance and high availability, Redshift does not contain bottlenecks due to analytics that utilise distributed storage, and DynamoDB is not rigid with structures that do not have schema design [28]. This holistic approach demonstrates the ability of AWS to remove the classic vices and use additional potential, such as real-time responsiveness and USB tolerance that had not been proactively previously discovered.

The competition, similar to the databases of AWS, is shown to be complementary. Aurora is transactionally consistent, Redshift provides it with the power to make in-depth analytical insights, and DynamoDB becomes agile to correlate with any dynamic and semi-structured data. A good example of such an interesting discovery is the hybrid ecosystem created by combining these databases in such a way that organisations are able to admit transactional as well as analytical and real-time workloads simultaneously [29]. This is a model package that has been suitable (fills a gap) in the literature, which has previously viewed such systems in isolation. The revelation highlights the fact that efficiency and strategic decision-making would be more efficient when such systems are not applied as autonomous solutions but as an interactive component.

The second significant discovery is that, in addition to the solution of technical deficiencies, AWS aids in the strategic alignment of the digital transformation. The distributed architecture also presents auto-scalability that ensures stable performance and cost economy, as compared to traditional hardware-based systems, which is aided by the pay-as-you-go model. The central integrative importance is another finding of the current study carried out. The SageMaker, Lambda, and Kinesis tools have served as the way forward in providing more than just the process of sending and receiving requests to their storage databases. Rather, they are able to execute at a machine learning level of analysis and real-time intelligence. Also, there is a small evidence provided to suggest that users who switch over to AWS have been enhanced with faster decision-making speed and enhanced long-term sustainability than the previous research that detected no direct correlation between the adoption of the database and the factors.

Implementations

- Organisations can adopt a hybrid AWS strategy that combines relational, data warehouse, and NoSQL databases to manage diverse workloads effectively.
- Enterprises should integrate AWS databases with advanced services such as analytics and machine learning to maximise their transformative potential.

Limitations

- The study relies solely on secondary qualitative data, which limits direct validation through primary evidence.
- Findings are based on current AWS offerings that may evolve rapidly, creating challenges for long-term generalisation.

VI. FUTURE DIRECTION

An extension of this study can use primary data collected in the form of case studies, interviews, or surveys of organisations currently utilising AWS databases. Also, the qualitative knowledge will be further supplemented by quantitative analysis based on performance indicators or financial values. This will provide additional balanced knowledge regarding the transformative power of AWS databases in the contemporary data management solution. The findings also may be strengthened by comparison to AWS and other rival cloud providers such as Microsoft Azure or Google Cloud, given that it will augment the view of the industry [30]. Using a qualitative with quantitative approach, it is easy to understand the research analysis using text details with the statistical details. This can help to balance the knowledge regarding the transformative power of AWS databases over the traditional data management approach.

VII CONCLUSION

The research concludes that the AWS relational database, the data warehouse database and the NoSQL database have been conclusively proven to have some unique and complementary benefits over the traditional ones. AWS solutions offer business flexibility, integration and long-term sustainability by removing barriers such as inflexibility, excessive costliness, and scalability. The thematic analysis showed that the actual power of AWS is not in each of the features but in the synthesised advantages. This allows the organisations to become efficient, innovative, and transform digitally. Altogether, AWS databases prove to be strategic forces behind the future business in the data-seeking environment.

VIII. REFERENCES

[1] Boukraa, D., Bala, M. and Rizzi, S., (2024). Metadata management in data lake environments: a survey. *Journal of Library Metadata,* 24(4), pp.215-274.

[2] Shareef, T.H., Sharif, K.H. and Rashid, B.N., (2022). A survey of comparison different cloud database performance: SQL and NoSQL. *Passer Journal of Basic and Applied Sciences*, 4(1), pp.45-57.

[3] Maswanganyi, N.G., Fumani, N.M., Khoza, J.K., Thango, B.A. and Matshaka, L., (2024). Evaluating the impact of database and data warehouse technologies on organizational performance: A systematic review.

[16] Arrais, M., Bravet, R.M., Ciccone, L., Cocharero, A.N., Kurauchi, E. and Rozestraten, H., (2023). AWS Certified Database Study Guide: Specialty (DBS-C01) Exam. *John Wiley & Sons.*

[4] Panwar, V., (2024). Leveraging AWS APIS for Database Scalability and Flexibility: A Case Study Approach. *International Journal of Engineering Applied Sciences and Technology,* 8(11), pp.44-52.

[5] Dong, H., Zhang, C., Li, G. and Zhang, H., (2024). Cloud-native databases: A survey. *IEEE Transactions on Knowledge and Data Engineering*, 36(12), pp.7772-7791.

[6] Panwar, V., (2024). Leveraging AWS APIS for Database Scalability and Flexibility: A Case Study Approach. *International Journal of Engineering Applied Sciences and Technology,* 8(11), pp.44-52.

[7] Bateman, S., Gnanachandran, J. and DeMuth, J., (2023). Geospatial Data Analytics on AWS.

[8] Venkata, B., (2022). Cloud Resiliency Engineering: Best Practices for Ensuring High Availability in Multi-Cloud Architectures.

[9] Cotton, A.D., (2021). The Systemic Risk of Consolidation in the Cloud Computing Industry. *University of Missouri-Kansas City.*

[10] Pothecary, R., (2021). Running Microsoft Workloads on AWS. *Apress*.

[11] Team, M.V., (2023), June. Data Migration from Relational to NoSQL Database: Review and Comparative Study. *In International Conference on Advanced Intelligent Systems for Sustainable Development: Volume 1-Advanced Intelligent Systems on Artificial Intelligence, Software, and Data Science* (Vol. 637, p. 252). Springer Nature.

[12] Antu, A.D., Kumar, A., Kelley, R. and Xie, B., (2021), December. Comparative Analysis of Cloud Storage Options for Diverse Application Requirements. *In International Conference on Cloud Computing* (pp. 75-96). Cham: Springer International Publishing.

[13] Bhowmick, P.R., (2021). Overview of NOSQL Databases.

[14] Singh, A., (2022). Evolution of Data Processing and Management: A Comparative Analysis of Traditional and Modern Big Data Architectures. *International Journal of Artificial Intelligence, Data Science, and Machine Learning,* 3(1), pp.18-27.

[15] Rassam, M., Alfarhan, A. and Alhussain, R., (2021). Cloud Database Security Issues and Challenges: A Review. *Journal of Innovative Information and Communication Technology,* 1(1), pp.21-31.

[17] Ankomah, E., Haruna, C.R., Akotoye, F.X.K., Agyemang, B., Agyekum, K.O.B.O., Asante, A., Ephrim, L. and Kissiedu, A.N., (2022, December). A comparative analysis of security features and

concerns in NoSQL databases. *In International Conference on Frontiers in Cyber Security* (pp. 349-364). Singapore: Springer Nature Singapore.

[18] Bharany, S., Kaur, K., Eltaher, S.E.M., Ibrahim, A.O., Sharma, S. and Abd Elsalam, M.M.M., (2023). A comparative study of cloud data portability frameworks for analyzing object to nosql database mapping from ondm's perspective. *International Journal of Advanced Computer Science and Applications,* 14(10).

[19] Kalchenko, D., (2023). Performance comparison for different NoSQL Cloud Database Management Systems.

[20] Lupaiescu, S., Cioata, P., Turcu, C.E., Gherman, O., Turcu, C.O. and Paslaru, G., (2022). Centralized vs. decentralized: Performance comparison between bigchaindb and amazon qldb. *Applied Sciences,* 13(1), p.499.

[21] Rao, A., Khankhoje, D., Namdev, U., Bhadane, C. and Dongre, D., (2022). Insights into NoSQL databases using financial data: A comparative analysis. *Procedia Computer Science*, 215, pp.8-23.

[22] Olsowy, L.M.V., Tesone, F., Thomas, P., Delia, L. and Pesado, P., (2021), May. Performance Analysis in NoSQL Databases, Relational Databases and NoSQL Databases. *In Computer Science–CACIC 2020: 26th Argentine Congress, CACIC 2020, San Justo, Buenos Aires, Argentina, October 5–9, 2020, Revised Selected Papers* (Vol. 1409, p. 157). Springer Nature.

[23] Pothecary, R., (2021). Databases. *In Running Microsoft Workloads on AWS: Active Directory, Databases, Development, and More* (pp. 81-109). Berkeley, CA: Apress.

[24] Rousidis, D. and Koukaras, P., (2023). From Relational to NoSQL Databases–Comparison and Popularity Graph Databases and the Neo4j Use Cases. *In Graph Databases* (pp. 1-35). CRC Press.

[25] Higginson, A.S., (2022). Database Clouds-Accounting, Forecasting and Workload Placement from Complex RDBMS Architectures. *The University of Manchester (United Kingdom)*.

[26] Qaiser, A., Farooq, M.U., Mustafa, S.M.N. and Abrar, N., (2023). Comparative analysis of ETL tools in big data analytics. *Pakistan Journal of Engineering and Technology,* 6(1), pp.7-12.

[27] Ljungdahl, V., (2023). Performance comparison of distributed MySQL andMongoDB in a cloud environment.

[28] Kenitar, S.B., Arioua, M. and Yahyaoui, M., (2023). A novel approach of latency and energy efficiency analysis of IIoT with SQL and NoSQL databases communication. *IEEE Access,* 11, pp.129247-129257.

[29] Ionescu, S.A. and Diaconita, V., (2023). Transforming financial decision-making: the interplay of AI, cloud computing and advanced data management technologies. *International Journal of Computers Communications & Control,* 18(6).

[30] Wang, H. and Wang, S., (2023). Teaching tip: Teaching NoSQL databases in a database course for business students. *Journal of Information Systems Education*, 34(1), pp.32-40.