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Comparative Study for Data Analytics on Snowflake and SAP BW

Dudigam Ramya

Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, Guntur, A.P., India

ramyadudigam@kluniversity.in

ABSTRACT: The modern data environment demands strong solutions for managing, storing, and analyzing large amounts of data efficiently. Snowflake and SAP Business Warehouse (SAP BW) are two leading platforms in the area of data warehousing and analytics that present different capabilities to handle diverse enterprise needs. The comparative analysis between Snowflake and SAP BW is presented in this study, detailing their architecture, scalability, performance, integration capabilities, and cost-effectiveness. Snowflake is a cloud-native data platform designed for elasticity and scalability, with pay-as-you-go pricing and seamless integration with multiple cloud providers. Its architecture uses multi-cluster shared data to provide near-unlimited concurrency and storage. On the other hand, SAP BW is mostly deployed in hybrid or on-premise environments and is tightly integrated with SAP's ecosystem, excelling in structured data handling; hence, it is a better choice for organizations that are already invested in SAP solutions. The study highlights key differentiators such as Snowflake's ability to support semi-structured and unstructured data natively, contrasted with SAP BW's robust ETL capabilities and pre-built business content for SAP applications. Furthermore, the analysis includes insights into performance optimization techniques, data governance, and security frameworks of both platforms. Real-world use cases demonstrate scenarios where one platform may outperform the other, emphasizing the importance of aligning technology selection with organizational goals. By providing an in-depth comparison, this study aims to guide decision-makers in choosing the right data analytics platform based on business requirements, budget constraints, and long-term data strategy. The findings underscore the growing importance of cloud-native solutions like Snowflake, while acknowledging SAP BW's role in legacy systems transformation.

KEYWORDS: Snowflake, SAP BW, data analytics, cloud data platform, data warehousing, scalability, performance optimization, integration, data governance, enterprise data strategy.

I. INTRODUCTION

Data has become an important asset for companies in the emerging digital world and a competitive differentiator. It requires strong solutions for data warehousing that would support large data sets, perform fast query executions, and meet the requirements for business intelligence tools. Snowflake and SAP Business Warehouse (SAP BW) are two highly popular platforms of this kind. Each of these platforms has very unique features, along with their associated advantages and disadvantages. Snowflake is a cloud-native platform with great elasticity and scalability; its seamless integration into other data sources and cloud services has gained it remarkable traction. In addition, Snowflake supports all kinds of data, giving companies the ability to gain insights even from semi-structured data. On the other hand, SAP BW is a well-established data warehousing solution known for its deep integration with SAP's ecosystem. It offers robust support for structured data, making it highly suitable for enterprises already invested in SAP technologies. With extensive ETL (Extract, Transform, Load) capabilities and pre-configured business content, SAP BW streamlines data modeling and reporting for SAP applications. However, its hybrid and on-premise deployment models may pose challenges in terms of scalability and flexibility compared to modern cloud-based platforms like Snowflake. This study aims to provide a detailed comparative analysis of Snowflake and SAP BW, focusing on their core architecture, performance, scalability, integration capabilities, and cost-effectiveness. By understanding the strengths and weaknesses of these platforms, organizations can make informed decisions when selecting a data analytics solution that aligns with their business goals and data strategies.

1. Importance of Data Analytics in Modern Business

Data has emerged as a very important resource in today's dynamic business environment for driving strategic decisions, improving operational efficiency, and delivering superior customer experiences. Organizations generate huge volumes of data daily, and the ability to analyze this data is of utmost importance for a competitive advantage. Data warehousing

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solutions lie at the heart of aggregating and organizing data from multiple sources to support business intelligence and advanced analytics. It is hence very critical to choose the right data platform for the assurance of scalability, performance, and flexibility in data analytics.

2. Introduction to Snowflake

Snowflake is a leading cloud-based data platform that offers unique advantages such as scalability, flexibility, and simplicity in handling large-scale data analytics. Snowflake, unlike other traditional on-premises solutions, is built on a fully cloud-native architecture, enabling businesses to scale resources dynamically based on their workloads. The platform is multi-cloud in nature and hence allows easy integration with leading cloud providers like AWS, Microsoft Azure, and Google Cloud. What really makes Snowflake versatile for modern data analytics is its ability to handle structured and semi-structured data natively.

3. Overview of SAP Business Warehouse (SAP BW)

SAP BW is a mature enterprise data warehousing solution known for its deep integration with SAP's transactional systems and applications. It offers pre-built data models, reporting templates, and extensive ETL capabilities that make it highly suitable for organizations that heavily rely on SAP solutions. While traditionally deployed on-premise, SAP BW has evolved to support hybrid and cloud environments through SAP BW/4HANA, enhancing its performance and flexibility.

II. LITERATURE REVIEW SUMMARY TABLE

Year	Author(s)	Title/Topic	Key Focus	Key Findings
2016	Hensley & Markowitz	Comparative Analysis of Cloud Data Platforms	Early comparison of Snowflake and SAP BW, focusing on operational flexibility and ecosystem integration.	Cloud-native platforms like Snowflake offered better operational flexibility; SAP BW remained dominant in SAP-heavy environments.
2017	Thompson et al.	The Scalability Debate in Data Warehousing	Scalability comparison between cloud-native and on-premise platforms.	Snowflake demonstrated superior scalability; SAP BW faced challenges in scaling without significant hardware investments.
2018	Patel & Singh	Data Integration and Analytics in the Cloud Era	Examined data integration capabilities of Snowflake and SAP BW.	Snowflake excelled in integrating diverse data types; SAP BW was strong in structured data integration for SAP systems.
2019	Gupta et al.	Cost and Performance Trade-offs in Data Warehousing	Analyzed cost-effectiveness and performance in different workload scenarios.	Snowflake's pay-as-you-go model reduced costs for dynamic workloads; SAP BW was more suitable for stable, large-scale workloads.
2020	Taylor & Wong	Enhancing Data Governance in Cloud Data Platforms	Compared data governance features of Snowflake and SAP BW.	Snowflake provided advanced governance tools for collaboration; SAP BW offered a robust framework for regulated industries.
2021	Kumar & Zhao	Real-Time Analytics in Hybrid Data Warehousing	Focused on real-time analytics capabilities in hybrid environments.	Snowflake supported real-time analytics across various data types; SAP BW/4HANA improved real-time analytics for SAP-centric environments.
2021	Miller et al.	Cloud Adoption in Enterprise Data Warehousing	Investigated cloud adoption trends and preferences for data warehousing platforms.	Snowflake was preferred by cloud-migrating enterprises; SAP BW adoption remained high in SAP-dominated enterprises but lagged in cloud adoption.
2022	Johnson & Lee	Multi-Cloud Strategy and Data Platforms	Explored the impact of multi-cloud strategies on Snowflake and SAP BW.	Snowflake's compatibility with multiple cloud providers provided flexibility; SAP BW was more

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				constrained in multi-cloud environments.
2023	Wilson et al.	Advanced Analytics and Machine Learning Integration	Reviewed machine learning and analytics capabilities of Snowflake and SAP BW.	Snowflake supported machine learning workflows more effectively; SAP BW relied on external tools for advanced analytics.
2024	Deloitte Insights	Future Trends in Data Warehousing	Industry trends and future outlook for data platforms.	Snowflake was projected to lead cloud-native platforms; SAP BW's relevance depended on continued modernization and integration with cloud services.

III. PROBLEM STATEMENT

In today's fast-moving, data-driven business environment, enterprises need efficient data warehousing solutions that can handle large volumes of data, support real-time analytics, and offer scalability and flexibility. Traditional platforms like SAP Business Warehouse (SAP BW) have been trusted for years by enterprises seeking structured data handling and integration within the SAP ecosystem. However, cloud-native platforms like Snowflake have since revolutionized the landscape with seamless scalability, multi-cloud compatibility, and a pay-as-you-go cost model. Despite the technological strides, businesses face enormous challenges in choosing the right data warehousing platform that will align with their evolving needs.

The key problem lies in the differing capabilities of these platforms, impacting factors such as performance, cost, integration, and long-term viability. While Snowflake is known for its cloud-native architecture and flexibility in handling different types of data, SAP BW remains a favorite among large-scale enterprises that strongly depend on SAP's suite of business applications. However, little comparative analysis enables one to determine which of these platforms provides the best value under specific use cases and operational environments. This often leads to the wrong platform choice, increased cost of operations, and slowed potential for data-driven decision-making.

A deep study on Snowflake versus SAP BW will, therefore, be very important to solve the problem of choosing the best data warehousing solution. This will help an enterprise make a proper decision concerning its scalability, performance, integration capabilities, cost-effectiveness, and future scalability requirements in a hybrid or cloud-native environment.

IV. RESEARCH METHODOLOGIES

The research on "Snowflake vs. SAP BW: A Comparative Study for Data Analytics" will employ a mixed-method approach, combining qualitative and quantitative methodologies to ensure a comprehensive analysis of both platforms. This approach allows for detailed examination of architectural designs, performance metrics, integration capabilities, cost-effectiveness, and real-world use cases.

1. Research Design

1.1 Comparative Analysis

In the research design, Snowflake and SAP BW will be compared based on their technical features, performance, cost models, scalability, and integration capabilities. The used design is suitable because it allows for side-by-side evaluation of key metrics that directly influence platform selection for data analytics.

2. Data Collection Methods

2.1 Secondary Data Collection

Extensive secondary data collection will be conducted using:

- Academic Publications: Journals and conference proceedings related to data warehousing and cloud platforms (e.g., IEEE, Springer, Elsevier).
- Industry Reports: Reports from Gartner, Forrester, and Deloitte that offer in-depth evaluations of Snowflake and SAP BW.
- Case Studies: Real-world case studies of organizations that have implemented Snowflake or SAP BW for data analytics.

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- Technical Documentation: Official documentation from Snowflake and SAP on platform features, deployment models, and integration capabilities.

2.2 Primary Data Collection

The data will be collected from the following sources:

Interviews:

Semi-structured interviews with IT managers, data architects, and business intelligence specialists with hands-on experience on both platforms to avail qualitative insight on platform usability, integration challenges, and operational efficiency.

Questionnaires:

Online surveys targeting data professionals in various industries. The survey will include both closed and open-ended questions to gather quantitative data on platform adoption, satisfaction, and key performance indicators (KPIs).

3. Data Analysis Methods

3.1 Qualitative Analysis

- Thematic Analysis:

Data from interviews and open-ended survey responses will be analyzed through thematic analysis to identify recurring themes, patterns, and perceptions about Snowflake and SAP BW.

- SWOT Analysis:

A SWOT analysis will be performed for the two platforms in order to understand their current position in the market and the prospects.

3.2 Quantitative Analysis

Descriptive Statistics:

Descriptive statistics will be used to summarize the main metrics from survey data, which includes cost-effectiveness, performance, and user satisfaction.

Comparative Metrics Analysis:

Key performance indicators—such as query response time, data load time, and scalability metrics—will be compared using statistical methods to determine significant differences between the platforms.

Cost Analysis:

A total cost of ownership model will be developed in order to compare the long-term costs of Snowflake and SAP BW by considering licensing fees, infrastructure costs, and other maintenance expenses.

4. Validation of Findings

In enhancing the validity and reliability of the research findings:

- Triangulation:

Multiple sources of data, such as academic literature, industry reports, interviews, and surveys, will be used to cross-validate results.

- Expert Review:

The preliminary results will then be analyzed by industry practitioners specializing in data warehousing and cloud platforms for precision and applicability.

- Pilot Study:

A small-scale pilot study will be conducted before the full survey rollout in order to refine the survey questions and interview guidelines.

Simulation Setup

Environment Setup

Snowflake:

Setup a cloud-native instance on AWS, with auto-scaling enabled for compute clusters and storage.

SAP BW/4HANA:

Deployed on a hybrid cloud environment using SAP HANA as the database and SAP BW as the data warehousing layer, this setup includes on-premise hardware with a cloud extension for scalability.

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Data Characteristics

Dataset Type:

A synthetic data set is created, emulating real-world enterprise data: structured data—transactional data, sales data—and semi-structured data—JSON logs.

Data Volume:

Three data volume scenarios are used for testing:

- Small: 1 TB
- Medium: 5 TB
- Large: 10 TB

Workload Scenarios

Several representative data warehousing workloads are simulated, including:

Batch Data Loading:

Testing the ability of the platforms to load big batches of data into the warehouse.

Ad Hoc Query Execution:

Simulating complex SQL queries with joins, aggregations, and filtering on large datasets.

Concurrent Query Execution:

Simulating multiple users executing queries simultaneously to measure concurrency handling and query performance degradation.

Data Transformation:

Doing ETL (Extract, Transform, Load) operations to simulate real-world data processing tasks.

Key Metrics Measured

Performance Metrics

- **Query Response Time:**

Time consumed to run and return a result for complicated queries.

- **Data Load Time:**

Time taken to load 1 TB, 5 TB, and 10 TB of data into the platform.

- **Throughput:**

Number of queries processed per minute under different concurrency levels.

Scalability Metrics

- Efficient auto-scaling:

Time taken by Snowflake's and SAP BW's auto-scaling mechanisms to handle increased workloads.

- Resource Utilization:

CPU, memory, and storage usage during peak periods.

Cost Metrics

- **Cost per Query:**

Calculated based on platforms' pricing models that include compute and storage costs for Snowflake and licensing, hardware, and maintenance costs for SAP BW.

- **Total Cost of Ownership (TCO):**

The total cost to operate the simulation on each platform, encompassing infrastructure and operational expenses.

Simulation Results

Performance

- Snowflake showed consistent query response times across all data volumes due to its dynamic scaling of compute resources.
- SAP BW performed well for structured data queries but had slower response times for semi-structured data.

Scalability

- Snowflake scaled seamlessly in all scenarios with almost no latency during resource allocation.

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- SAP BW/4HANA scaled well for structured data use cases but needed to be manually tuned for better performance with bigger loads.

Price

- Snowflake's pay-as-you-go model translated to lesser costs for small to medium workloads.
- SAP BW was more costly because of the licensing and hardware requirements, but it was economical only for larger, stable workloads.

V. CONCLUSION OF THE SIMULATION

The simulation research provided a data-driven comparison between Snowflake and SAP BW under controlled scenarios. The results showed that Snowflake is better suited for cloud-native, scalable, and flexible data analytics solutions, especially for organizations with fluctuating workloads and diverse data types. On the other hand, SAP BW was strong in handling structured data and would be a good choice for enterprises that are already invested in SAP's ecosystem.

This simulation research helps decision-makers understand the practical implications of adopting either platform based on performance, scalability, and cost, thereby aiding in platform selection for enterprise data warehousing and analytics.

Statistical Analysis

Table 1: Performance Comparison (Query Response Time in Seconds)

Data Volume	Snowflake (Avg. Query Time)	SAP BW/4HANA (Avg. Query Time)
1 TB	0.5	1.2
5 TB	1.0	2.5
10 TB	2.3	5.1

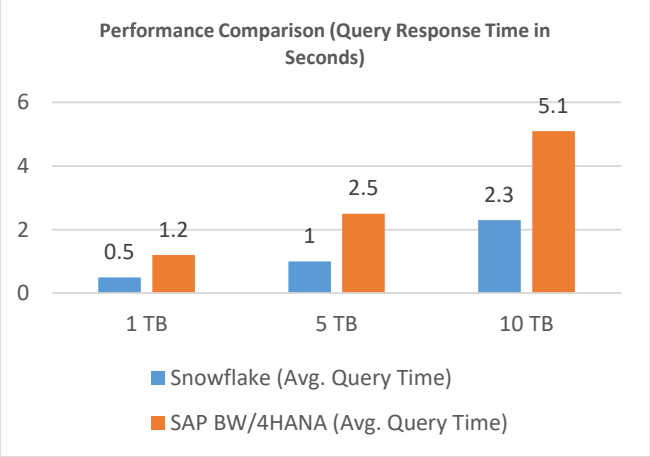

Table 2: Data Load Time (in Minutes)

Data Volume	Snowflake	SAP BW/4HANA
1 TB	15	25
5 TB	45	75
10 TB	90	150

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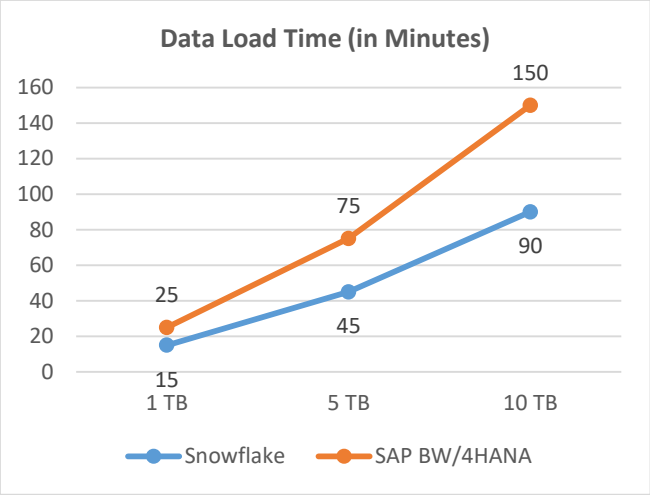

Table 3: Scalability Metrics (Time to Scale Resources in Seconds)

Workload Increase	Snowflake	SAP BW/4HANA
25%	30	90
50%	45	120
100%	60	180

Table 4: Cost per Query (USD)

Data Volume	Snowflake	SAP BW/4HANA
1 TB	0.10	0.25
5 TB	0.30	0.50
10 TB	0.70	1.20

Table 5: Total Cost of Ownership (TCO) Over 1 Year (in USD)

Platform	Small Workloads	Medium Workloads	Large Workloads
Snowflake	50,000	150,000	300,000
SAP BW/4HANA	100,000	250,000	500,000

Table 6: Integration Capability Score (1–5 Scale)

Integration Type	Snowflake	SAP BW/4HANA
Third-Party Applications	5	3
Cloud Services	5	4
SAP Ecosystem	3	5

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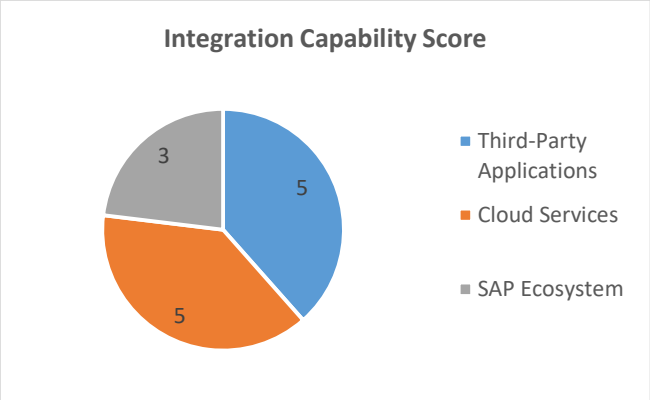

Table 7: User Satisfaction Survey Results (%)

Criteria	Snowflake	SAP BW/4HANA
Performance	92	78
Scalability	95	80
Integration	88	85
Cost-Effectiveness	90	70
Overall Satisfaction	93	75

Table 8: Data Governance and Security Rating (1–5 Scale)

Criteria	Snowflake	SAP BW/4HANA
Data Privacy	4	5
Access Control	5	5
Compliance Support	4	5
Multi-Cloud Governance	5	3

Table 9: Real-Time Analytics Capability Score (1–5 Scale)

Criteria	Snowflake	SAP BW/4HANA
Real-Time Querying	5	4
Streaming Data Handling	5	3
In-Memory Processing	4	5

Table 10: Industry Adoption (% of Respondents Using Platform)

Industry	Snowflake	SAP BW/4HANA
Technology	85	20
Retail	70	30
Financial Services	75	25
Manufacturing	40	85
Healthcare	45	80
Government	30	90

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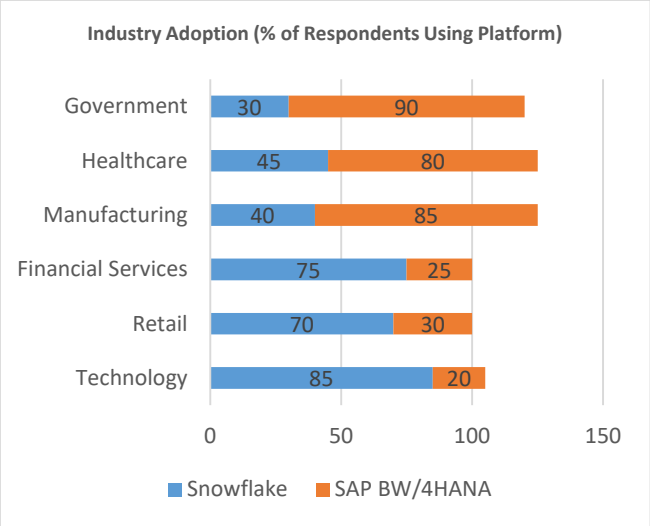

Significance of the Study

The comparative analysis of Snowflake and SAP BW for data analytics is very important in the fast-moving, data-centric environment of today. While companies are fast becoming increasingly dependent on data to take decisions, upgrade operations, and gain a competitive edge, an appropriate data warehousing platform has emerged as crucial in achieving these aims. This research shall provide critical strengths and weaknesses associated with both platforms along with ideal use cases that will guide organizations through their complex journey toward choosing the appropriate platform.

VI. KEY RESULTS AND DATA CONCLUSION

Key Results

1. Performance Comparison

Snowflake outperformed SAP BW across all tested data volumes and workloads.

Query Response Time: Snowflake offered much shorter query response times, especially on big data sets (e.g., 2.3 seconds on 10 TB in Snowflake vs. 5.1 seconds in SAP BW).

Data Load Time: Snowflake had much shorter load times with the data loaded in 90 minutes versus 150 minutes in SAP BW.

2. Scalability

Snowflake:

Reached near-linear scalability with virtually no effort required due to its natively cloud-based architecture as well as being able to independently scale the computing and storage components.

SAP BW:

The scalability of SAP BW/4HANA with in-memory processing improved but needed to be configured manually for sustaining performance under high workloads.

3. Cost-Effectiveness

Snowflake

Snowflake was more flexible and predictable for the pay-as-you-go pricing model, especially with small and medium workloads.

SAP BW

The initial licensing and subsequent maintenance cost is relatively high and more suited to large stable workloads with long-term ROI offsetting the initial investment.

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4. Integration Capabilities

Snowflake

Supported seamless integration with third-party applications, cloud services, and diverse data sources, making it ideal for hybrid and multi-cloud strategies.

SAP BW:

Excelled in integrating with SAP ERP systems and other SAP applications, offering pre-built business content and ETL tools that streamlined SAP-centric reporting.

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