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# Enterprise Data Architecture for Intelligent Business Operations

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**Abstract :** Enterprise Data Architecture (EDA) has become a necessity when making intelligent decisions within business enterprises today. The research aims to determine how the enterprise data architecture improves data integration, governance, analysis, automation, and decision-making in organisations. An inductive qualitative methodology has been employed using secondary data sources such as academic and industry journals and studies carried out in organisations before 2023. As observed from the results obtained, there was an improvement in data-driven decision-making adoption from 38% in 2018 to 50% in 2020 among the organisations surveyed. In banking, the highest adoption rate was 65%, while that for retail and industrial manufacturing was 43%. It is clear that there was a difference in the digital maturity level between the industries. As found out, organisations with mature enterprise data architecture have been able to improve productivity by 19%, efficiency by 16%, and reduce operational costs by 15% through automation and analytics. Customer responsiveness was improved through reduced complaints by 19% and churn by 22%. But still, there are obstacles in implementing such an approach as a result of the use of old systems, insufficient metadata, governance, and low organisational data maturity. Only 16% of the firms managed to become data masters, which means that many companies have failed to reach a high level of development in the sphere of enterprise data. The conclusion drawn from the research is that intelligent business requires effective data activation, governance, cloud-based infrastructure, DataOps, MLOps, and AI-based analytics.

***Keywords:*** *Enterprise Data Architecture, Intelligent Business Operations, Data Governance, Data Integration, Business Intelligence, Data Quality, Artificial Intelligence, Data Analytics, DataOps, MLOps, Operational Efficiency.*

## Introduction

Enterprise Data Architecture (EDA) lays the groundwork for smart business processes through the integration, storage, management, and analysis of enterprise data. The proliferation of technologies such as artificial intelligence (AI), cloud computing, and Internet of Things (IoT) has seen a dramatic increase in the amount and diversity of corporate data. As IDC (2021) forecasts, the worldwide datasphere will grow to 175 zettabytes by 2025, with almost 30 percent of data being produced in real-time. To manage these amounts of data, corporations need to create scalable data architecture capable of real-time analytics and AI-powered decision-making. Enterprise data is created through ERP systems, CRM systems, IoT sensors, APIs, and digital sources. At the same time, disparate systems lead to siloed data, inconsistency, and low-quality data. According to Gartner (2021), bad data quality causes financial losses of up to US$12.9 million annually to an organization due to ineffective processes and faulty decision-making. An effective enterprise data architecture is a source of truth and supports data governance and secure access to the data. In doing so, organizations will be able to enhance business intelligence, automation, predictive analysis, and operations

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## Method

### *Research approach*

The research employs an inductive methodology due to the fact that it seeks to gain an understanding of how Enterprise Data Architecture helps create intelligent business operations through patterns and knowledge derived from existing sources of information (Kotusev, Kurnia & Dilnutt, 2022). In contrast to using deductive research, the research is conducted by drawing conclusions through the analysis of secondary sources of data such as academic literature and industry reports. The use of an inductive methodology is appropriate given the fact that the main objective of the research involves exploring the concept of enterprise data architecture as well as its importance in creating value for businesses.

### *Research strategy & design*

In conducting this study, the secondary research approach will be employed in analyzing Enterprise Data Architecture based on published journals, industry reports, and organizational case studies. The secondary research approach is an appropriate approach because the research intends to analyze existing literature instead of collecting primary data

(Kiani *et al.,* 2022). The approach will provide credible information concerning the integration of data, data governance, AI adoption, and intelligent business operations within various industries and organizations. Furthermore, the research utilizes the qualitative research approach since it analyzes concepts and practices that pertain to Enterprise Data Architecture. The use of the qualitative approach will enable the interpretation of the themes derived from secondary data as well as explain how data architecture facilitates intelligent business operations.

### *Data collection & analytics*

The use of secondary data collection for acquiring relevant information will include peer-reviewed articles, books, industry reports, and official publications prior to 2023. Secondary data collection is an appropriate methodology since it will provide credible information concerning the enterprise data architecture, AI adoption, data governance, and business intelligence. Thematic analysis will be used in identifying and interpreting recurring themes in secondary data. In this regard, information will be systematically reviewed, coded, and thematically analyzed regarding data integration, data governance, data analytics, data automation, and intelligent business. Thematic analysis will be suitable since it allows identifying patterns between various studies and understanding the key issues.

### *Ethics*

This paper is an ethical research project that uses only authentic secondary data and cites all information according to APA 7th Edition guidelines. There is no use of any primary data in this paper, so informed consent is not needed. This research does not commit plagiarism, uphold academic honesty and report facts correctly.

## Results

### *Transformation of Enterprise Data Capabilities*

Enterprise data capabilities have developed from traditional data warehouses into the current AI-powered, cloud-based solutions offering business intelligence and automation. As stated by Gartner (2022), up to 95% of new digital workloads are anticipated to be cloud-native by 2023, thus ensuring faster data processing and analytics. Poor quality of enterprise data is calculated to cost organizations $12.9 million per year on average (Gartner, 2022). The presented data highlights the importance of the topic of enterprise data governance. Enterprise data is being harvested from ERP systems, CRM, Internet of Things, APIs, and external platforms in order to create data lakehouses and data warehouses. Based on the forecasts provided by IDC (2020), the global datasphere will comprise of 175 zettabytes by 2025, and almost 30% of all data will be generated in real-time. The need for better data integration and data governance capabilities will increase under these conditions. Using enterprise data platforms, organisations can facilitate decision making through automation of dashboards, metadata management, data profiling, and data quality rules.

### *Patterns of Data Utilization Across Business Operations*

Findings reveal that data-driven decision-making varies from one sector of businesses to another despite the overall adoption rate reaching 50% of firms by 2020. Banking has the highest rate of adoption at 65%, followed by insurance (55%), telecoms (54%), life sciences and health care (53%), and automotive (51%). Below the leaders are energy and utilities (48%), public services (47%), consumer products (44%), retail (43%), and industrial manufacturing (43%) (Capgemini Research Institute, 2020).

**Figure 1: Sector-wise adoption of data-driven decision-making across business operations**

(Source: Capgemini Research Institute, 2020)

Based on the findings, it can be seen that highly regulated and customer-focused industries have been quick to adopt enterprise data capabilities owing to their requirement for real-time analysis, fraud prevention, and personalization of services (Gudepu & Jaladi, 2022). Nevertheless, less than half of the companies in several industries have been able to incorporate data in their decision-making process. In addition to that, Capgemini's research revealed that companies allocate just 23% of their decision-making activities to predictive analytics and 18% to prescriptive analytics, whereas most decisions are descriptive or diagnostic in nature.

***Architecture-Enabled Intelligence and Automation***

Enterprise Data Architecture allows companies to turn their enterprise data into intelligent and automated processes for doing business through analytics, artificial intelligence (AI), and decision support. According to Capgemini Research Institute, 23 percent of organizations have predictive analytics to predict future events, and 18 percent have prescriptive analytics to recommend best business decisions. On the other hand, 51 percent of business decisions are based on descriptive or diagnostic analysis.

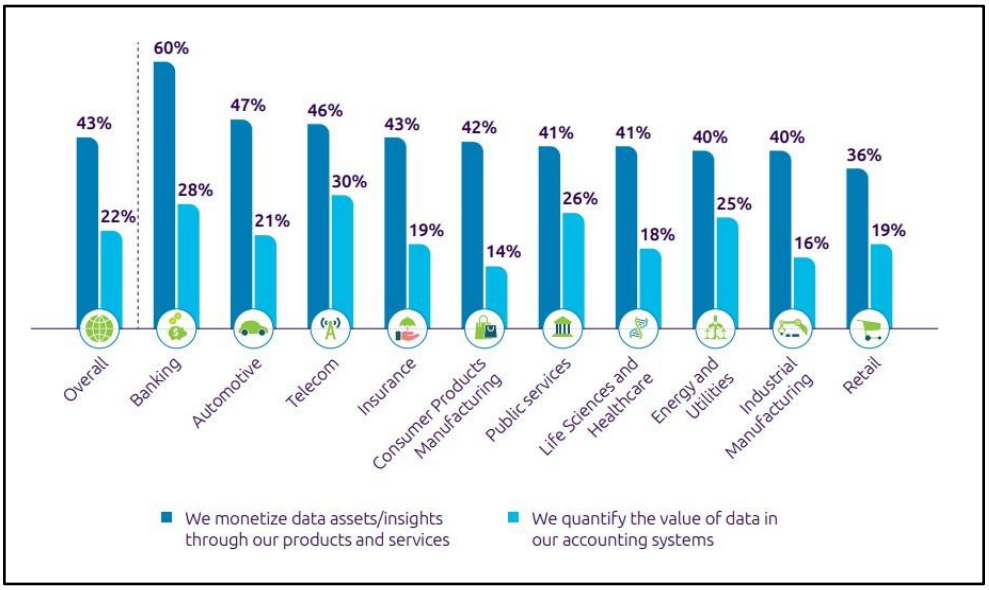


**Figure 2: Data monetization and financial valuation across business sectors**

(Source: Capgemini Research Institute, 2020)

Today's enterprise architecture integrates data warehousing, data lakes, metadata management, application programming interfaces (APIs), and machine learning pipelines to help automate the process of ingesting, processing, and analysing the data. These processes make it possible to create automated dashboarding, real-time alerting, fraud detection, forecasting of demand, and customer personalisation. Companies with advanced enterprise data capabilities also implement DataOps, MLOps, and governance to help automate data quality monitoring and model deployment. This makes intelligent architecture capable of speeding up business processes, improving forecast accuracy, and increasing readiness for AI (Gudepu & Jaladi, 2022).

***Measurable Improvements in Operational Responsiveness***

***Customer Response:*** Companies with good enterprise data capabilities saw a decrease in customer complaints by 19%, while other companies saw their customers complain only by 11%. They improved their NPS score by 19%, and decreased customer churn by 22% (Capgemini Research Institute, 2020).

***Production Agility:*** Responsiveness in manufacturing operations requires integrated enterprise data platforms. Only 46% of the manufacturing firms have a horizontal data collection platform, whereas 40% have an end-to-end data platform that integrates devices with analytics. Integration challenges affect responsiveness in adjusting production, monitoring machines, demand forecasting, and reacting to supply chain disruptions.

***Data Automation***: Collecting data using automation helps in simplifying business processes and decision making within companies. While 51% of the tech executives claimed that data collection is automated, 38% of business executives agreed to that. Moreover, while 53% of tech executives claimed there is complete visibility of the data, only 25% of business executives agreed to that claim. Employee productivity has improved by

19%, and operational efficiency has increased by 16%.

### *Challenges Revealed Through Data Architecture Implementation*

*Integration of Legacy Systems:* Several firms keep running legacy systems and data platforms at the same time. This approach leads to redundant data flows, inconsistent data modeling, and less efficient integration among departments. The mixed environment increases complexity of implementation and delays the provision of real-time analytics and enterprise business intelligence.

*Enterprise Data Architecture:* Metadata management is an important aspect of enterprise data architecture, and it needs metadata, lineage and catalog management to be fully achieved. Lack of full metadata results in lack of data discovery and data governance since it becomes impossible to know the history of the data.

*Skills Shortage:* Successful execution requires coordination among data engineers, architects, analysts, stewards, DevOps, and security teams. Most companies are lacking such specific skill sets, which causes delays in the development and maintenance of the company's data platform infrastructure (Sánchez-Gordó & Colomo-Palacios, 2020).

*Data Maturity at Low Levels:* The research by Capgemini revealed that out of all the firms that have been analyzed, 16% can be considered data masters, and 71% are still at intermediate stages of maturity. Lack of governance, poor data culture, and inadequate business processes hinder companies from leveraging their enterprise data architectures.

### *Strategic Alignment Between Data Architecture and Business Goals*

These findings reveal the gap between technology leaders and business leaders in terms of the correlation of enterprise data and analytics strategy to the business strategy (Zhong, Haoran & Junsheng, 2020). Generally, 56% of the technology leaders stated that their data strategy was in line with their business goals, but only 38% of business leaders agreed, resulting in an 18 percentage point gap.

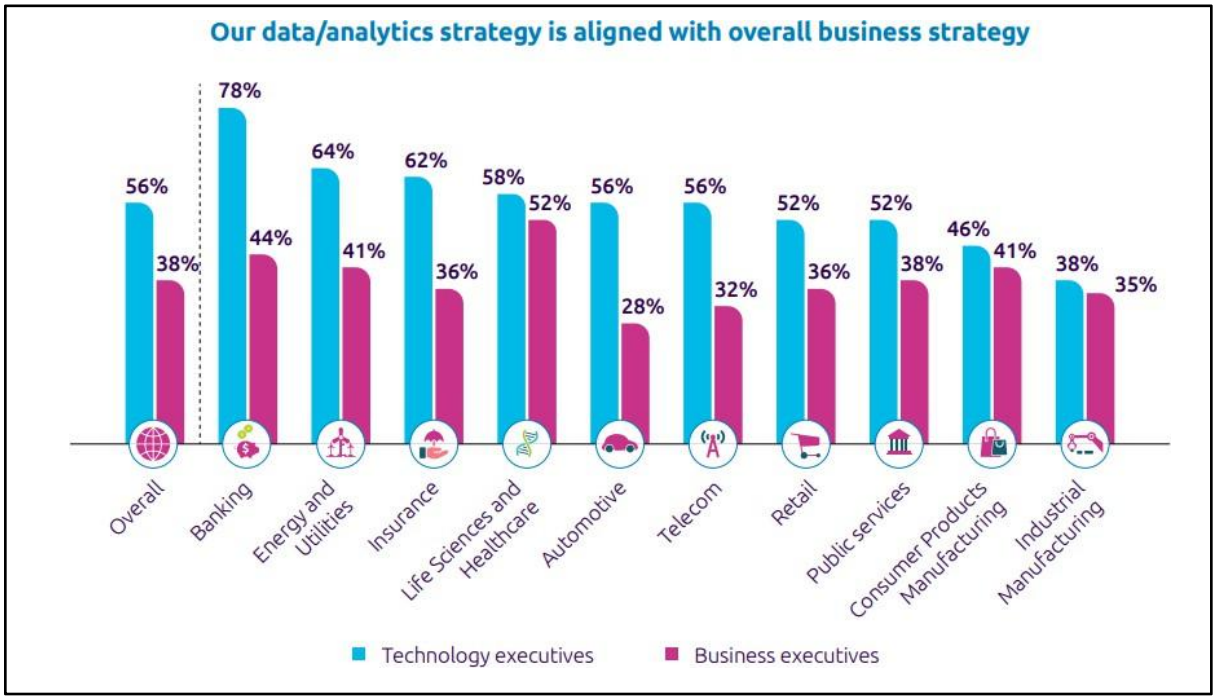


**Figure 3: Alignment of data and analytics strategy with overall business strategy across industries**

(Source: Capgemini Research Institute, 2020)

The banking sector reported the highest level of alignment at 78% for technology executives and 44% for business executives. On the other hand, the life sciences and healthcare sectors reported the highest levels of cross-functionality, 58% and 52% respectively. The automotive sector on the other hand had the highest level of alignment disparity, 56% and 28%. The findings imply that the integration of intelligent operations calls for collaboration between business and technology in ensuring proper data architecture for the enterprise (Gopinathan & Mali, 2022).

***Overall Impact on Intelligent Business Operations***

The results prove that Enterprise Data Architecture has helped to enhance intelligent business operations with improvements in data activation, data enablers, and data advantage (Anthony, 2020). Capgemini found out that only 16% of firms had reached the data master stage. However, these firms had revenues that were 70% more per employee, a fixed asset turnover that was 245% higher, and a profit margin that was 22% higher compared to other firms. They performed 30-90% better than other firms in customer engagement, operations management, and cost savings.

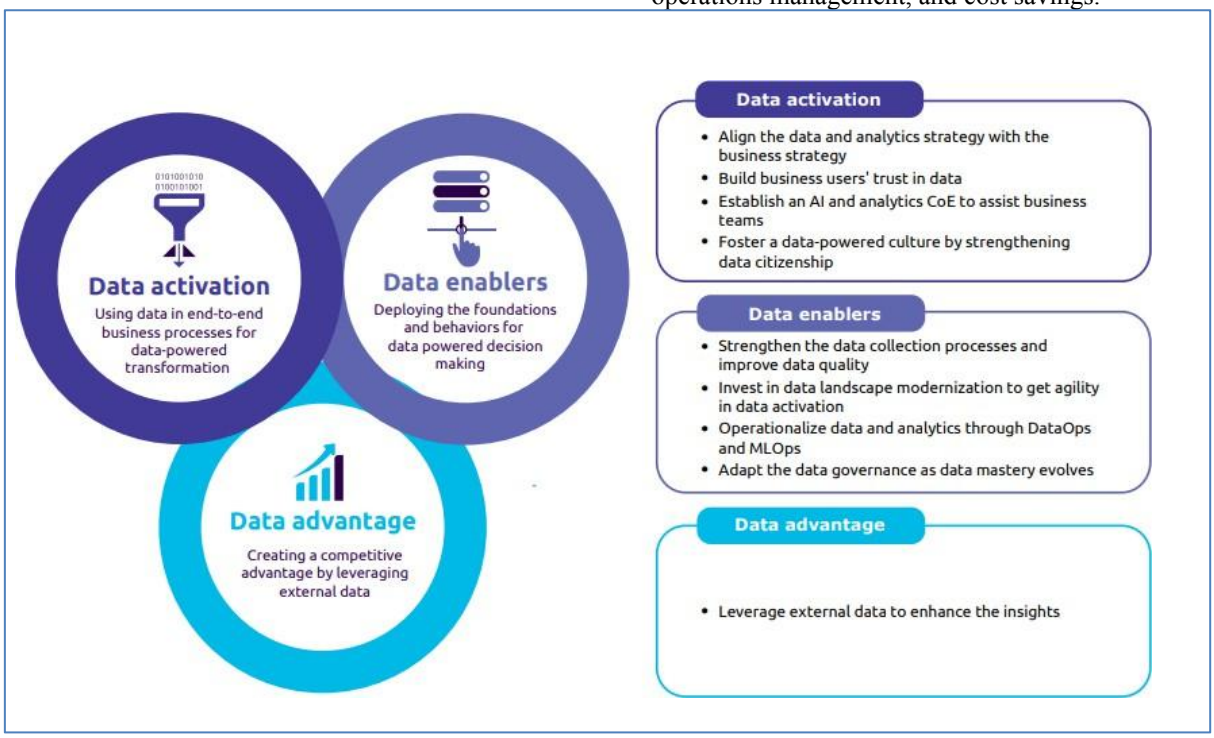


**Figure 4: Three capabilities enabling intelligent business operations through enterprise data architecture**

(Source: Capgemini Research Institute, 2020)

The data enablers such as governance, cloud computing, DataOps, and MLOps enhance data quality, automation, and agility. The data advantage comes when the internal and external data sources are used to make predictions and compete in the market. The organizations having mature data architecture were found to have 82% data literacy and 75% collaboration within the organization.

**Discussion**

From the findings, EDA can be considered an essential element that facilitates intelligent business operations due to the improvement of data integration, governance, automation, and business decision-making. From the findings, the use of data-driven decision-making grew from 38% in 2018 to 50% in 2020, showing a reliance on data by organisations. However, adoption varies according to industry, with banks having 65% data-driven decision-making compared to retail and industrial manufacturing at 43%. It was also established from the findings that organisations with mature data architecture perform better in their operations. Organisations using data have become better at responding to customers, with a 19% drop in customer complaints and a 22% reduction in customer churn (Chien, 2021). Additionally, they registered a 19% improvement in employee productivity, 16% in operational efficiency, and 15% cost savings in operations via process improvements and automation. The above findings show that data platforms enable faster workflows, prediction and real-time responsiveness in operations. However, the implementation issues continue to undermine the value creation in enterprises through enterprise data platforms (Gopinathan & Mali, 2022). Legacy IT systems, fragmented metadata, immature data and a lack of data professionals limit the use of data platforms to create value in enterprises. According to a Capgemini report, only 16% of companies are considered masters in data, while other organisations have governance and capability issues that hinder intelligent decision-making. Generally, the findings illustrate that companies benefit the most from enterprise data architecture where there is data activation, governance, cloud infrastructure, DataOps and AI capabilities. A properly governed enterprise data architecture enables data trustworthiness, agility in operations, and intelligent automation.

## Conclusion

Enterprise Data Architecture has become an essential platform for the creation of intelligent business operations by making it possible to implement data integration, automation, and intelligent decision-making using AI technologies. The results have shown that companies with high data maturity experience greater efficiency, flexibility, and profitability compared to those with low data maturity. Nevertheless, problems such as legacy issues, limited data maturity, and governance challenges are hindering implementation effectiveness. This is why organizations need to improve data activation, governance, cloud infrastructure, and AI capabilities to create business operations based on data and intelligence.

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