The Role of Data Governance, Integration Architecture, and AI-Enabled Analytics in Enhancing Decision-Making Effectiveness: Evidence from the Telecom Sector in Saudi Arabia

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Article History:

Submitted: Aug 04, 2025
Revised: Aug 21, 2025
Accepted: Sep 29, 2025
Published online: Oct 30, 2025

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Abstract

Purpose—This study investigated the influence of data governance and quality management, integration architecture design, and AI-enabled analytics on decision-making effectiveness in the Saudi Arabian telecom sector.

Study Design/methodology/approach—Primary data were collected from a sample of 370 data architects, engineers, and analytics professionals employed at Saudi Telecom Company (STC) and its partner organizations. A structured questionnaire was used to capture perceptions of governance practices, data integration capabilities, and AI-driven analytics.

Findings—The results demonstrated that data governance and quality management significantly improved decision-making effectiveness by ensuring data reliability, regulatory compliance, and trust in business intelligence systems. Integration architecture design was also found to have a positive effect, enabling organizations to unify structured, semi-structured, and unstructured data into coherent platforms that support real-time insights. In addition, AI-enabled analytics played a critical role in driving decision-making effectiveness by providing predictive intelligence, uncovering hidden patterns, and enhancing the speed and accuracy of strategic choices.

Research Practical Implications— This study provides empirical evidence from Saudi Arabia, demonstrating that telecom organizations can strengthen their decision-making capabilities by integrating robust governance frameworks, scalable data architectures, and AI-enabled analytics.

Originality/value—The findings contribute to both academic research and industry practice, showing how enterprise data management and modern analytics platforms create a foundation for more effective and agile decision.

Keywords: Data Governance, Integration Architecture, AI-Enabled Analytics, Decision-Making Effectiveness, Telecom, Saudi Arabia.

1| Introduction

Data is one of the most important strategic resources of organizations in all industries, and the telecom sector is one of the most data-intensive industries due to the global digital economy. Telecom providers create and manipulate large amounts of structured and unstructured data every day, including customer data and billing data, network performance data, and unstructured customer support data. Digital transformation agenda in Saudi Arabia has focused on telecommunications as part of the vision 2030, and Saudi Telecom Company (STC) is one of the players in the market that have been on the frontline to enhance connectivity, smart services, and new digital platforms (Alqahtani, 2023). The resulting national push to digital has put a premium on data management, data integration and advanced analytics as the means to achieve operational efficiency, regulatory compliance and competitive advantage. However, the quality of decision-making remains low as telecom firms face the problem of data silos, inconsistent quality, disconnected system architecture, and inadequate integration of artificial intelligence into strategic processes, in spite of all the available data (Kusumawati, 2025).

It is against this backdrop that entities within the Saudi telecom industry are trying to convert raw data into actionable information that can guide operational as well as strategic decision-making. The complexity, velocity and variety of telecom data can no longer be adequately captured using traditional reporting and business intelligence practices. Instead, businesses are increasingly focusing on how they can integrate sound data governance principles, invest in scalable and interoperable integration platforms and leverage AI-powered analytics platforms that can deliver predictive and prescriptive intelligence (Mamun, 2025). This convergence of the three areas, governance, architecture, and analytics, has become increasingly urgent because executives and data professionals understand that disjointed practices erode confidence in data, reduce the speed of decisions and limit innovation. Therefore, a study of the interdependence of these areas and their overall impact on the effectiveness of decision-making has theoretical and practical importance, especially in the rapidly developing digital economy of Saudi Arabia (Jaradat et al., 2025).

Generally, data governance can be described as the system of procedures, policy, standards and roles that guarantee the availability, integrity, usability and security of data throughout the organization. It provides a systematic way of managing data as an enterprise resource, and decision-makers can rely on the data to be correct and compliant. In telecom companies where the privacy of customers, integrity of the network, and financial reporting policies are highly regulated, good governance mechanisms instill trust in the information that underlies the daily business and strategic programs (Kolade et al., 2024). Further, data quality management as a governance dimension guarantees that data sets are complete, consistent, and timely--qualities that are essential to maintaining competitive performance in high-speed, high-volume environments. Without any governing mechanism in place, it is not possible to trust data and any decisions based on such data can lead to inefficiency, breach of regulations or lost opportunities (Viljoen, 2021).

By contrast, integration architecture can be described as the design and implementation of systems and platforms that facilitate the communication and coordination of disparate data sources. Integration architecture is the key to the consolidation of various types of data in the telecom industry, such as structured transactional data with billing systems, semi-structured data with customer interactions and unstructured data in the form of call transcripts or social media posts. By removing silos and making sure organizational stakeholders can see critical information in one, consistent way, effective integration facilitates real-time or near-real-time insights (Pandy, 2025). Flexible, scalable and interoperable architectures enable organizations to respond swiftly to changes in the market and technology disruption. With respect to the effective use of the decision-making, an effective

integration architecture can help the decision-makers address the integrated and holistic view and the current information, instead of the disintegrated and old information (Crescenzi, 2025).

AI-powered analytics is an extension of the decision support capabilities of descriptive and diagnostic analytics to predictive and prescriptive intelligence. AI gives organizations the capability to identify trends and predict future trends, as well as simulate possible outcomes, which could be obscured in large volumes of data. The AI analytics can be applied to other telecom company applications, such as churn, fraud, network optimization, and personal customer engagements (Adeniran et al., 2024). AI decreases cognitive load, increases reaction time, and improves the accuracy of strategic decisions by adding machine intelligence to human decision-making. In that way, AI-enabled analytics will transform data into an active generator of novelty and vision, not a dead store of the past (Luukka, 2025).

These three dimensions, namely governance, integration architecture, and AI analytics, are closely intertwined when it comes to determining the effectiveness of decision-making. The reliability and trust principles are established by the data governance, the availability and integratability are established by the integration architecture, and the value is extracted by the AI analytics through the transformation of uncoded information into actionable information. These relationships are based on the theoretical framework of the socio-technical systems approach and could be referred to as the interconnectivity of technological infrastructures and organizational processes to generate the intended effects (Li et al., 2020). Likewise, the theories of decision making indicate that the quality of the input information, the speed of the processing systems, and the level of available analysis have a direct effect on the quality of the decisions. Thus, the current study frames the concept of data governance, integration architecture, and AI-supported analytics into complementary enablers that jointly describe the difference in decision-making performance in the telecom industry (Pamisetty, 2025).

Although more and more studies are focused on data governance frameworks, enterprise integration, and analytics adoption, the literature is still inconsistent as most researchers have studied these constructs separately, but not in combination. Data governance studies tend to emphasize compliance and stewardship without adequately articulating the way in which governance is converted into decision outcomes. Integration architecture studies are often technical, focusing on design models with little or no consideration of the organizational implications of integration to decision-making (Bjorklund et al., 2020). Likewise, the majority of AI-based analytics studies have focused on technical performance or adoption-related issues, and little has been done to examine the impact of such tools on the performance of managerial and strategic decisions. In addition, most current literature is based in Western or East Asian settings, and little empirical data is found in the Middle East, and practically none of the studies investigate the particular dynamics of the Saudi telecom industry (Zhao, 2025).

The research problem is thus how governance, integration and analytics interact to make decision making processes more effective in a sector and regional environment that has received limited research. Telecom organizations in Saudi Arabia are operating in an extremely competitive environment, which has been influenced by the high rate of technological change, changing consumer preferences and extremely strict regulatory frameworks. Nevertheless, the process of decision-making is not rewarded after investing in the process of digitalization due to its relatively low quality because of the disaggregation of the information, lack of equality in governance, and poor utilization of AI opportunities (Qian, 2025). This poses an urgent necessity of empirical studies which not only confirm the direct effects of these constructs, but also substantiate their associations with each other in predicting the results of decision-making processes.

2| LITERATURE REVIEW

Empirical research studies conducted across various industries have also shown that organizations with robust governing mechanisms are in a better position to achieve regulatory accolade, improve the reliability of their information, and become transparent (Kolade et al., 2024). Governance is especially relevant to the telecom industry, as the information about customers is sensitive, the regulations protecting it are rigid, and the inaccurate information can lead to billing and customer experience management, as well as network optimization. It is further disclosed that, as a synergizing practice with quality management practices, governance is positively correlated to the measures of organizational performance, and thus it can be argued that the practices of governance are not merely bureaucratic necessities but strategic enabling features of knowledgeable decision-making (Egala et al., 2025).

Integration architecture has been researched mainly in the area of enterprise architecture and systems integration. Integration architecture is based on the theoretical framework of systems theory that postulates that the value of an organizations data ecosystem is dependent on the interconnections and interoperability of the individual components of the system. Decision-makers are confronted with delays, redundancies and gaps in fragmented environments where data is scattered in silos and thus loses its effectiveness. Empirical studies regarding the context of enterprise resource planning (ERPs) systems and middleware integration observed that successful integration architectures allow data to be easily moved, lower transactional costs, and provide a single perspective of organizational performance to decision-makers (Chukwuma-Eke et al., 2021). Integration architecture can be applied in the context of telecom organizations to bring structured billing data, semi-structured call detail records, and unstructured customer interactions together into coherent platforms that can enable advanced analytics. Research has also validated that system integration enables agility, flexibility, and responsiveness to enable firms to react faster to market, customer, and regulatory changes (Gong and Ribiere, 2025).

The AI-based analytics literature is based on the decision support system theory and the newly developed concept of augmented intelligence. Theoretically, AI analytics broadens the human decision-making spectrum by offering predictive and prescriptive analytics that are fully independent of descriptive reporting. Researchers have reasoned that AI is another dimension of decision-making process, a process that will make organizations be proactive rather than reactive to changes in their environment. Customers: As it has been stated, predictive insights may be used by telecommunication companies, to make them more efficient and make their customers more satisfied, and there is empirical evidence of the use of AI in telecom-related areas, such as fraud detection, predicting customer churn, and network optimization (Wanda, 2024). It has also been discovered that AI-enabled analytics can speed up decision making, enhance accuracy, minimize uncertainty, and aid innovation, revealing patterns that a human analyst could miss. However, the literature has also cautioned that, without governance and integration, the benefits of AI analytics may be undermined by poor quality inputs or fragmented sources of information, which justify the claim that these three constructs are not independent variables but reinforcing (Shipilov and Gawer, 2020).

There is also empirical evidence to indicate the synergistic relationships between governance, integration, and analytics. Research within the healthcare and financial services sectors, such as the examples above, has demonstrated that governance practices can guarantee the credibility of inputs into analytics models, whereas integration architectures can facilitate consolidation of various datasets into platforms that may be used with AI applications. Equally, studies of digital transformation have highlighted that AI has the most value to organizations when incorporated into strong governance systems and enabled through adaptable integration architecture (Berlato et al.,

2025). The data shows that in the telecom sector alone, companies that co-invest in governance, integration and analytics perform better in the domain of customer experience management, fraud prevention, and operational efficiency than do companies that undertake these activities independently. However, regardless of these observations, empirical studies that investigate these constructs in combination have not been done extensively, especially in the Middle East and Saudi Arabia, where the digital transformation is quickly transforming the telecom industry (Neffati, 2025).

The use of data-driven strategies in meeting the national goals of digital transformation has been increasingly highlighted in recent literature. Smart cities, digital services, and knowledge economies, in particular, are a focus of Vision 2030 in Saudi Arabia, and telecom companies have a central role in facilitating such initiatives. In that regard, empirical research has demonstrated relevance of digital infrastructure, innovation, and analytics capabilities to the realization of national competitiveness. Nevertheless, little research has been conducted to determine the combined impact of governance, integration and AI analytics on the effectiveness of decision making in telecom organizations. This is a major research gap as in Saudi Arabia, with its special regulatory, cultural and technological context, the alignment of the organizational data strategies with the national digital agendas presents a challenge and an opportunity.

3| METHODOLOGY & DESIGN

In the current work, a quantitative research design is used because the aim of the study is to empirically verify the association between data governance, integration architecture, AI-enabled analytics, and decision-making effectiveness. The structured and positivist approach was considered the most suitable as in this way the research aims to test causal relationships among clearly identified constructs through statistical analysis and not to dwell upon subjective meanings or stories. The research is guided by the positivist philosophy that knowledge can be objectively measured and validated by systematic observation, data collection and analysis. The philosophical disposition is in line with the adoption of systematic interventions and statistical models such as Structural Equation Modeling (SEM), which allow testing of theoretical relationships in a rigorous and replicable manner.

This study population includes data architects, engineers, analytics professionals and decision-makers who work at the telecom industry in Saudi Arabia. Saudi Arabia has been chosen as a context due to the accelerated digitalization of the telecom sector of the country, which is reflective of the global transition to data-centric business conditions. In Saudi Arabia, telecom operators produce huge amounts of customer, operational, and financial data providing a rich opportunity to research the impact of governance, integration, and analytics practices on decision-making effectiveness. The target population is therefore by definition professionals directly engaged in the management, integration, and use of enterprise data assets, and who have the requisite expertise to assess organizational practices and the effects they have on decision-making processes.

The research uses the purposive approach of sampling to ensure that the respondents have been selected with respect to groups with relevant knowledge and job responsibilities. A sample of 370 participants was selected as a sufficient sample, out of the population in Saudi Arabia, having in mind the recommendations in the literature on SEM; the sample size needed to conduct model testing is between 200 and 400 participants. To capture the wide range of perspectives and to reduce organizational bias, the sample was spread among leading telecom organizations in Saudi Arabia, comprising operators, service providers and their partner organizations. The purposive method will make the respondents familiar with the constructs being studied, and the sample size will offer adequate statistical power to identify any significant relationships amongst variables.

The structured survey questionnaire was used as the main tool of collecting empirical evidence through which data collection was conducted. The questionnaire had been developed by modifying

the question items found in the existing literature on data governance, integration architecture, AI-enabled analytics, and decision-making effectiveness. The operationalization of each construct was done with several indicators on a five-point Likert scale of strongly disagree to strongly agree. A small sample of experts was used to pretest the instrument in order to gain clarity, content validity, and reliability and in the process, changes were made to enhance the accuracy of the instrument. The survey was administered electronically in a bid to cover a large number of people and collect the data efficiently and with a high level of response to ensure the participation of the professionals in the various regions of Saudi Arabia. To ensure honesty in answers, the respondents were guaranteed anonymity and confidentiality.

The data collected were evaluated through Structural Equation Modeling (SEM), a well-known method of simultaneously testing multifaceted relationships among latent constructs. SEM allows validation of both measurement and structural models and, in addition, the constructs are measured reliably as well as testing the proposed relationships. The analysis was conducted in two phases to establish the validity and reliability of the model of measurement and to determine convergent validity, discriminant validity, and internal consistency: 1) the validity and reliability of the measurement model were evaluated during the first phase, which was the confirmation of the factor analysis (CFA); 2) second phase was the determination of convergent and discriminant validity, as well as internal consistency. Second, the structural model was tested to challenge the hypothesized data governance, integration architecture, AI-enabled analytics, and the effectiveness of decision-making. SEM use offers a stringent statistical construct that increases validity and applicability of study findings.

The moral aspects were followed in the course of the research and made after the standards of academic integrity and the ethics of research were adhered to. Respondents were not compelled to participate in the study, were made aware of the study objective and the intended use of the data to be collected, and their right to drop out at any point without any repercussions. The administration of the questionnaire was performed under informed consent and all the answers were held under strict confidentiality. Information was made anonymous to prevent the disclosure of subject identity and stored in a secure manner to prevent information leakage. Additionally, the questionnaire did not contain any intrusive or sensitive questions as it concentrated on professional practices and perceptions only, in relation to the study constructs. Such actions made the study to comply with respect, beneficence, and justice principles of research.

4| RESULTS AND ANALYSIS

4.1 | Reliability and Convergent Validity (Outer Loadings, Cronbach's Alpha, Composite Reliability, AVE)

Table 4.1 Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Data Governance (DG)	0.87	0.91	0.68
Integration Architecture (IA)	0.85	0.89	0.65
AI-Enabled Analytics (AI)	0.88	0.92	0.70
Decision-Making Effectiveness (DME)	0.90	0.93	0.71

The results of the reliability and convergent validity test indicate that every measure in the

four constructs of Data Governance, Integration Architecture, AI-Enabled Analytics and Decision-Making Effectiveness are above the suggested limits, therefore, confirming their measure strength. The Alpha of the items to measure each construct ranges between 0.85 and 0.90 which is much more satisfactory than the 0.70 mark indicating that the items are extremely consistent among themselves. Similarly, Composite Reliability (CR) scores of 0.89 to 0.93 have corroborated the argument that the indicators will always reflect their latent constructs exceeding the suggested 0.70. Further, the values of Average Variance Extracted (AVE) ranges between 0.65 and 0.71 and all values are above the level of 0.50, which is one of the criteria demonstrating that over half of the variance in the indicators is accounted by their respective constructs.

4.2 | Discriminant Validity – HTMT

Table 4.2 Discriminant Validity – HTMT

Constructs	DG	IA	AI	DME
DG	—			
IA	0.62	—		
AI	0.58	0.60	—	
DME	0.66	0.64	0.70	—

The findings of the HTMT discriminant validity test show that all inter-construct correlations are below the suggested value of 0.85, and all of them are empirically distinct. In particular, moderate relationships can be seen in the HTMT values of Data Governance and Integration Architecture (0.62), Data Governance and AI-Enabled Analytics (0.58), and Integration Architecture and AI-Enabled Analytics (0.60), indicating that though these constructs correlate, they represent distinct facets of how organisations use data. Likewise, the relationships between Decision-Making Effectiveness and each of the three antecedent variables: Data Governance (0.66), Integration Architecture (0.64), and AI-Enabled Analytics (0.70) are moderate in nature but fall within reasonable bounds, indicating that all predictors have a unique contribution to the explanation of decision-making results. In general, the results demonstrate the presence of discriminant validity, so the constructs included in the model are distinct enough to be included in the structural analysis.

4.3| Collinearity 4.3| Model Fit Summary (PLS-SEM Model Fit Indices)

Table 4.3 Multicollinearity Test

Indicators	VIF
DG1–DG4 (Data Governance)	1.8–2.2
IA1–IA4 (Integration Arch.)	1.6–2.1
AI1–AI4 (AI Analytics)	1.7–2.3
DME1–DME4 (Decision-Making)	1.5–2.0

The outcome of the multicollinearity test based on Variance Inflation Factor (VIF) values reveals that all indicators within the 4 constructs are far less than the conservative mark of 5.0 and their value is between 1.5 and 2.3. In Data Governance (1.8-2.2), Integration Architecture (1.6-2.1), AI-Enabled Analytics (1.7-2.3) as well as the Decision-Making Effectiveness (1.5-2.0), the outcomes show that there are no serious cases of collinearity between the indicators. This implies that there is no over-redundancy in the contribution of any item to its corresponding construct, which increases the reliability of the measurement model.

4.4| Model Fit Summary (PLS-SEM Model Fit Indices)

Table 4.4 Model Fit Summary

Model Fit Index	Value	Acceptable Threshold
SRMR (Standardized Root Mean Square Residual)	0.061	< 0.08
NFI (Normed Fit Index)	0.92	> 0.90
RMS_theta	0.09	< 0.12

The assessment of the model fit indicates that the structural model satisfies the laid down standards regarding goodness-of-fit, and is therefore adequate in interpretation. The SRMR of 0.061 is lower than the suggested value of 0.08, which means that the disparity between the actual and perceived correlations is very small and the model fits the data quite well. A NFI of 0.92 exceeds the cut-off of 0.90 indicating once again the model has the capacity to reproduce the covariance structure observed. Also, the value of RMS_theta 0.09 is significantly less than the maximum allowable value of 0.12, so the model of measurements can be considered free of excessive residual variances and, therefore, reliable.

4.5| Structural Model Results

Table 4.5 Structural Model Direct Results

Hypothesis	Path	β (Beta)	t-value	p-value	Supported
H1	DG → DME	0.31	5.42	0.000	Yes
H2	IA → DME	0.27	4.87	0.000	Yes
H3	AI → DME	0.39	6.13	0.000	Yes

The structural model outcomes confirm that all the relationships hypothesized are statistically significant and have a positive relationship with decision-making effectiveness. Decision-Making Effectiveness ($b = 0.31$, $t = 5.42$, $p < 0.001$) is one highly affected by the Data Governance and shows that an effective decision-making process is possible through the creation of trust and trustworthiness in the decision-making process of institutions through proper management of data quality and the governance of data.

The positive effect is also exerted by Integration Architecture ($b = 0.27$, $t = 4.87$, $p < 0.001$), implying that the capacity to consolidate various sources of data into relevant sites enhances the timeliness and breadth of information at the disposal of decision-makers. The predictor with the highest significance is AI-Enabled Analytics ($b = 0.39$, $t = 6.13$, $p < 0.001$), as predictive and prescriptive intelligence is critical in enhancing the speed, accuracy, and strategy of making decisions. Taken together, these results confirm each of the three hypotheses, showing that the three factors of governance, integration, and analytics play a crucial role in the efficiency of the decision-making process and that AI-enabled analytics is the most significant one.

1 | DISCUSSION

Theoretical implications of the research are applicable to the overall results. They confirm that the effectiveness of decision making is not predetermined by the single factor but the complementary impact of governance, integration and analytics and support the socio-technical systems theory and models of decision making that underline the mutually beneficial interdependence between the quality of information, the system structures and the analytical tools. The study will empirically confirm such interrelationships in the Saudi Arabian telecom industry to fill the gap of knowledge that exists in the literature because previous researchers focused on the three constructs individually or in other western context. The results reveal the conceptual model developed can be a

viable theoretical framework to inform future research project in the new markets and industries experiencing rapid digital transformation.

The researchers note in the conclusion of the study that the synergistic effect of data governance, integration architecture, and AI-based analytics has a strong positive impact on the quality of decision-making within the Saudi Arabian telecom industry. The results validate that the promise of governance and compliance is trust and compliance, the promise of accessibility and coherence is integration, and the promise of foresight and precision is AI analytics. A combination of these factors justifies an immense proportion of the variance in the effectiveness of decision making and thereby are complementary and interdependent in natural.

Acknowledgment: The authors would like to express their sincere thanks to the editor and the anonymous reviewers for their helpful comments and suggestions.

Author Contributions:

Sadd Zafar: Litrature, Introduction & Data Collection

Adil Riaz: Software, Methodology

All authors have read and agreed to the published version of the manuscript.

Declaration of Conflicting Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Funding: The author(s) received no financial support for the research, authorship, and/or publication of this article.

Data Availability Statement: Data that supports the findings of this study are available on request from the corresponding author.

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