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Original Research Article

AI Driven Decision Support Systems for SAP-Based Enterprise Operations in Saudi Arabia: Advancing Vision 2030

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Abstract: ***Purpose***: To develop an AI decision support governance framework for the SAP-enabled operations of Saudi enterprises in line with the priorities laid out for digital transformation, operational efficiency, competitiveness, and value creation through data in the Saudi Vision 2030 program. Design/methodology/approach: The study applies a systematic narrative review approach to literature and standards-related sources from 2020 to 2025, together with conceptual synthesis informed by SAP transformation practice. It follows the format of the attached SAP transformation paper by connecting the problem statement, review findings, research methodology, conceptual development of the framework, and practical implications thereof. ***Findings***: According to the review, the SAP decision support based on AI is most beneficial if predictive analytics, business intelligence, automation, generative AI, master data governance and human accountability work as an integrated decision-making structure. Practical implications: The enterprises in Saudi Arabia could utilize the suggested governance framework for improving planning, supply chain management, reliability, finance, governance, and decision-making speeds while addressing the cybersecurity issues, bias, data quality and risk of adoption. ***Originality/Value***: This paper contributes an AI decision support governance framework that combines enterprise architecture and SAP transformations with Vision 2030 objectives.

Keywords: Artificial Intelligence, SAP S/4HANA, Decision Support Systems, Enterprise Operations, Saudi Vision 2030, Business Intelligence, AI Governance, Digital Transformation.

1. INTRODUCTION

Enterprise decision-making systems have become critical due to Saudi Arabia's economy transformation that entails the need for digital systems that will generate decisions from raw and complex operational data. Digital transformation, productivity, competitiveness, and institutional effectiveness are central components of the Vision 2030 program. In this regard, SAP-based decision support systems entail the integration of finance, procurement, supply chain, human capital management, project delivery, asset management, and executive dashboard. As seen in the attached reference paper about business transformation through SAP, enterprises need to harmonize their operational landscape for sustainable digital transformation. Based on the paper, the focus here is to analyze the use of AI-based decision support systems in Saudi enterprises.

Decision support systems use various technologies including AI, business data, predictive

models, optimization rules, dashboards, and workflow triggers among others. Since 2020, digital transformations entail the integration of cloud ERP, SAP Business Technology Platform, SAP S/4HANA, advanced analytics, process mining, machine learning and generative AI among others. SAP defines digital transformation as the adoption of digital technologies into each and every aspect of an organization, involving both cultural and technological aspects (SAP, 2024). This makes digital transformation relevant to Saudi enterprises in terms of achieving their short-term performance and long-term objectives.

The main problem here is that although enterprises generate large volumes of operational data, they are not able to translate that data into governed decisions. Some factors that could make enterprises' use of AI initiatives ineffective include fragmented master data management, legacy customizations, weak data ownership, weak data governance, user resistance, and inconsistent executive leadership. AI technology could also present some security risks if algorithms are deployed without explainability, cyber security, ethical issues, and human accountability. Consequently, the aim of this paper is to generate a review-based AI-driven decision support framework for SAP-based operations in Saudi Arabia. Specifically, the study seeks to answer four research questions: How can AI improve SAP-based decision support? What capabilities are necessary for supporting Saudi Arabia Vision 2030 objectives? What are governance requirements for AI deployment? How can enterprises follow implementation guidelines for SAP-based decision support?

2. LITERATURE REVIEW

Research papers on digital transformation have been arguing that technology will only deliver value to organizations if it is part of a broader strategy, process design, people engagement, and governance practices. For example, Vial (2021) notes that while digitization involves technological solutions to organizational problems, digital transformation refers to structural and functional change in organizational operations. Similarly, Verhoef *et al*., (2021) distinguish between digitization, digitalization, and digital transformation. According to the authors, digital transformation involves redesigning organizational operating models. This point is especially important for organizations running SAP systems because the majority of the unsuccessful ERP implementations and advanced analytics have resulted from the misunderstanding that technology is an isolated initiative.

Recent studies on AI have established the following major capabilities of decision support systems. First, AI increases the accuracy of predictions through the discovery of patterns in historical and real-time data. Predictive capabilities allow organizations to conduct demand forecasting, inventory planning, maintenance planning, fraud detection, cash flow visualization, project-risk management, and work-force planning among others. Second, AI enables the identification of root causes of anomalies, exceptions, and process deviations, hence providing explanations. This is possible through process mining and intelligent analytics. Third, AI provides recommendation in terms of next-best actions, optimal schedule, risk scores, and scenarios analysis.

For SAP operations, these capabilities can be found within SAP S/4HANA, SAP Analytics Cloud, SAP BTP, SAP Datasphere, process automation and embedded AI services. SAP describes its Joule solution as an AI assistant that allows team members to collaborate across departments and take informed actions based on connected workflows (SAP, 2025). However, such AI assistant and predictive models heavily rely on quality enterprise data. The attached SAP transformation reference indicates that one of the biggest challenges that affect transformation initiatives is that of integration, legacy systems, data migration, stakeholders' resistance, and change management.

However, Saudi enterprises have a distinctive strategy that influences their approach to decision support through AI. The main strategy that is emphasized in the National Transformation Program is that of digital government, efficient service delivery and institutional excellence. SAP decision support systems could help Saudi enterprises to implement their Vision 2030 agenda through localization, industrial diversification, energy efficiency, resilience of the supply chain, financial governance, and performance measurement. The majority of oil, gas, mining, utility, health care, banking, and construction businesses are now required to make decisions using integrated data across business functions rather than using separate departmental reporting.

Lastly, there are some concerns about over-reliance on AI outputs without proper management. Most papers about AI governance recommend considerations for fair, explainable, and human-centered deployment of algorithms (Mökander *et al*., 2021; Floridi, 2023). When dealing with banks, energy companies, and health-care facilities that are regulated industries, decisions generated by AI must also be audited and comply with risk appetite. Hence, enterprise decision support should be designed as

augmented decision making rather than fully automatic AI decision-making. Enterprises need to understand the weaknesses, data assumptions, and confidence level behind AI recommendation before taking action.

3. METHODOLOGY

The proposed review will employ a structured narrative approach. Such an approach is suitable considering that the topic integrates elements of enterprise architecture, SAP transformation, AI decision support, governance and Saudi Vision 2030 strategy. An approach based exclusively on meta-analysis statistics would miss out on the logic of implementation specific to SAP companies. Therefore, the paper reviews the available literature in the form of scholarly and professional materials published in 2020-2025. This literature is then mapped against a conceptual framework.

The process of literature review consisted of five steps. Firstly, the scope has been specified, namely AI decision support systems for SAP-based enterprise operations. Secondly, the relevant sources have been collected through a comprehensive search of literature focusing on digital transformation, AI governance, ERP transformation, business intelligence, decision support, process automation and enterprise architecture. Thirdly, the attached paper about SAP transformation serves as a framework of choice, as it addresses research problem, literature review, methodology, transformation barriers and framework thinking. Fourthly, the evidence has been categorized into seven recurrent themes: data foundation, AI analytics, workflow integration, governance, user adoption, Vision 2030 alignment and measurable value. Fifthly, the themes have been synthesized into a framework applicable to Saudi enterprises.

The methodology employed here is conceptual and review-based and does not generate any primary survey results. This is appropriate for a paper targeting publication to Scopus, Web of Science, Elsevier, Springer or Emerald. The sources have been included due to their dates (2020-2025), language (English), relevance to AI or digital transformation in the context of enterprises and applicability to SAP operations. The sources excluded included references older than 2020, generic considerations of AI without relevance to enterprises, or no mention of decision support implications.

The analytical lens combines socio-technical systems theory and the governance-by-design approach. According to socio-technical thinking, a decision support system works successfully when all aspects are harmonized including people, process, data and technology. Governance-by-design involves embedding governance measures from the start instead of relying on post-hoc governance. In the SAP environment, this means that data owners, process owners, approval workflows, validation requirements, cyber security roles, reporting hierarchy and escalation policies should be determined in advance.

4. Proposed Framework

The proposed framework includes six layers. The first layer is the enterprise data foundation. It covers SAP S/4HANA transactional data, master data, historical data, market data, Internet-of-things (IoT) feeds, project data, financial data and data from non-SAP systems. Without a stable data foundation, the decision support system becomes unreliable. Master data governance, data lineage, data quality rules, access control and integration architecture should be prioritized. SAP Data sphere and SAP Business Technology Platform (BTP) could be used for this purpose.

The second layer is the intelligence layer. It comprises descriptive analytics, predictive models, machine learning algorithms, anomaly detection, optimization algorithms and generative AI assistants. This layer must be use-case-driven. In the case of procurement, AI can predict the likelihood of supplier's delay. In the case of asset management, AI can forecast equipment failure. In finance, AI can spot anomalies related to cash flow. In project management, AI can estimate the potential deviation from the initial schedule. In HR, AI can identify problems with workforce planning. Every algorithm needs to have a business owner, decision outcome and clear assumptions.

The third layer is the decision workflow layer. The value of AI depends on the integration into workflows within an enterprise. Otherwise, a prediction made in a dashboard will do nothing for improving operations. SAP workflows must integrate AI insights and convert them into alerts, approval requests, exception reports, scenarios and recommendations. For example, the SAP control tower solution might generate a procurement escalation if the risk exceeds certain thresholds. Similarly, a finance dashboard might trigger the deviation of actual working capital metrics from forecasts.

The fourth layer is governance and risk control. This layer establishes ownership, model validation, privacy protection, cyber security, audit trails, segregation of duties and human overrides. Respective governance practices depend on the risk involved in a particular use case. Examples of low-risk use cases may include report summarization and

information retrieval. Demand forecasting and inventory recommendations can be considered medium-risk use cases. Credit decisions, safety-critical asset recommendations or compliance-sensitive workforce planning fall under high-risk cases. The higher the risk, the stricter the validation and explainability should be.

The fifth layer is adoption and capability development. The SAP transformation paper mentions user resistance, stakeholder engagement and implementation partners as essential non-technical aspects. Likewise, AI decision support requires consideration of such factors. Users must understand the reasons behind the recommendations generated, their confidence level and when to escalate them. Training programs must be role-specific: executives require strategic KPI interpretation, managers – scenario planning, analysts – data literacy and models, operational staff – workflow integration.

The sixth layer is Vision 2030 value alignment. The success of AI decision support cannot be measured solely in technical metrics but in the contribution to Vision 2030 objectives. Some of these may include productivity improvement, cost reduction, capability development, energy efficiency, supply chain resilience, service quality, compliance transparency and knowledge economy.

5. RESULTS AND DISCUSSION

Based on this synthesis, it is reasonable to conclude that the most valuable SAP AI-based decision support arises from three ingredients: integrated data, governed intelligence and operational embedding. In the former case, a manager can see inter-enterprise relations instead of disconnected department-level measures. In the latter two cases, the AI-based recommendation is explainable, secure and within the scope of the risk appetite. Finally, operational embedding means that the AI recommendation changes the workflow instead of generating a passive report.

The first key point is that decision speed increases due to predictive analytics and real-time dash boarding in SAP data. Traditional reporting usually provides information about past facts. In contrast, AI decision support can forecast what is expected to occur and what needs to be done at once. This is especially valuable in complex Saudi sectors including energy, logistics, construction, banking and healthcare. Predictive analytics is capable of minimizing uncertainty associated with demand, procurement, maintenance and project management.

The second key point is that the value of AI decision support is conditional upon the degree of process standardization. In highly customized SAP landscapes, AI may be hard to scale as data definitions, workflows and master data requirements vary from business unit to business unit. This supports the idea emphasized in the attached reference paper about standardization, harmonization and consolidation. To achieve better results, Saudi companies should start with a process-focused approach and launch AI pilots only after the stabilization.

The third key point is related to the potential and governance of generative AI technologies. Copilot and agents using natural language generation have significant potential to assist SAP users in asking questions, summarizing exceptions, writing reports and interacting with enterprise applications. Based on the latest strategic directions of SAP in relation to AI, we can anticipate an increasing number of copilots and agents in the future. However, generative AI output may be incomplete or misleading in certain contexts if not based on the controlled enterprise data. Hence, controlled retrieval, role-based access, audit logging and user validation need to be implemented.

The fourth key point is related to the balance between excessive bureaucracy and too little controls. Both extreme situations have negative implications for the organization: the former stifles innovation; the latter generates unacceptable risks. In order to find a solution, we suggest a three-step maturity path beginning with foundation and integration, moving on to prediction and finishing with assistive automation and trusted optimization.

The fifth and final key point is that alignment with Vision 2030 improves the business case. AI-based decision support in SAP provides additional leverage for improving productivity, competitiveness of non-oil sectors, digital skills among Saudi nationals and institutional excellence. For instance, predictive maintenance can increase asset uptime. Procurement analytics can contribute to local supplier development. Financial analytics can enhance capital discipline. Executive dashboards can facilitate monitoring of national KPIs. These advantages are relevant for Saudi organizations participating in giga-projects, energy transition, localization of industries and transformation into digital government.

6. Tables and Implementation Guidance

It is suggested that an SAP enterprise begins implementation with identifying use cases. Enterprises should find frequent, data-intensive, impactful, manual and critical decisions. Potential use cases include inventory replenishment, procurement risk management, project cost variance, equipment maintenance, financial forecasting and performance

reporting for executives. Each use case should be evaluated for its value, feasibility, data preparedness, risk level and alignment with Vision 2030 objectives.

Once use cases are selected, an SAP enterprise is recommended to run a pilot project in order to validate the solution and ensure that AI improves decision making. The pilot project is aimed to check if an AI-based recommendation helps in reducing uncertainty associated with the decision. The measures to assess this effect may include improved forecast accuracy, reduced cycle time, saved costs, detected risks, improved compliance and user engagement. The pilot project involves users, SAP architects, data governance specialists, cyber security experts, compliance managers and process owners.

Scalability implies the integration of AI decision support into existing SAP workflows and the creation of role-based dashboards. It is essential to document data lineage, assumptions of modelling, model validation, escalation rules and user roles. One needs to keep track of model drift since it becomes outdated over time.

Graphical Representations

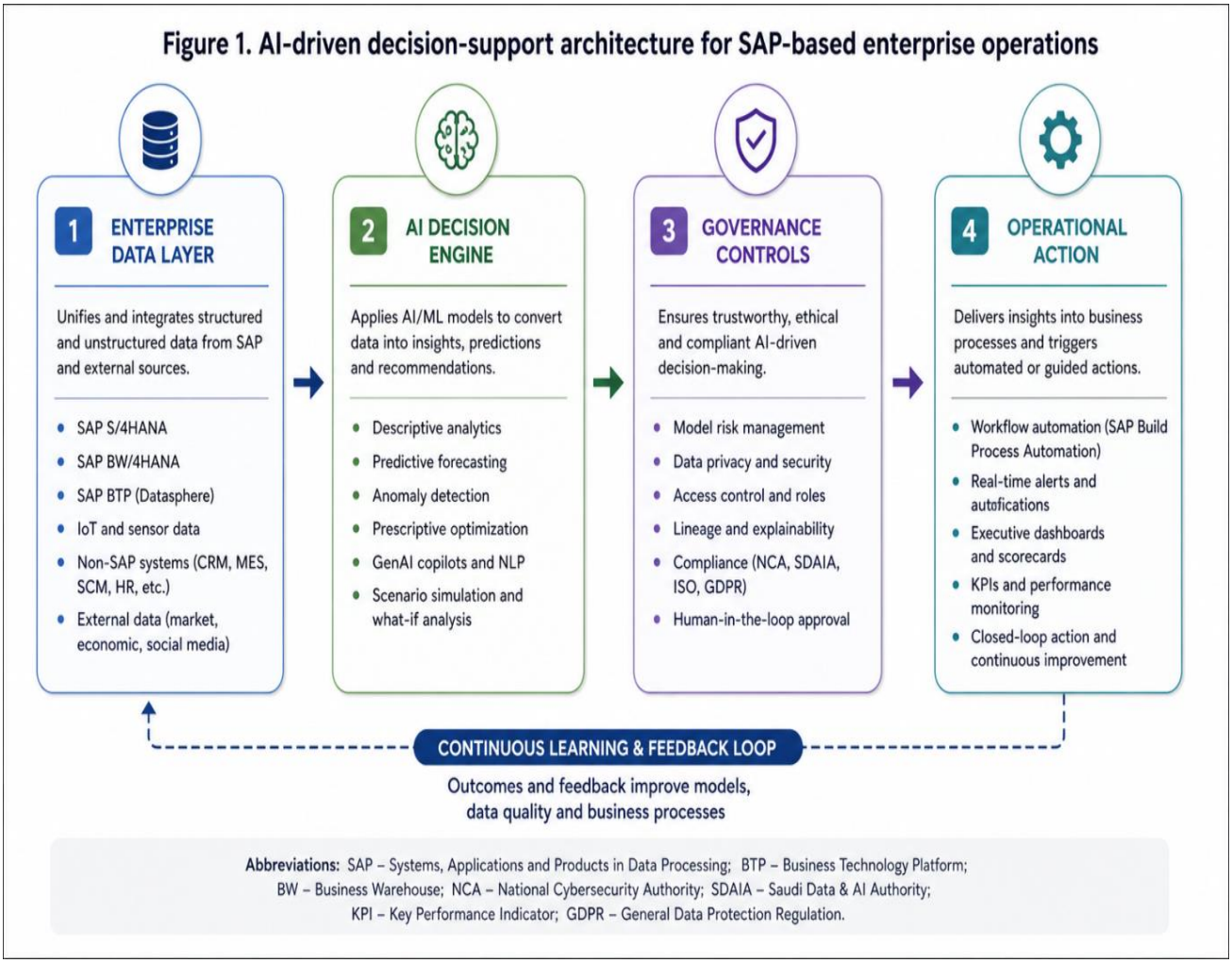

Figure 1: Apple-inspired conceptual architecture showing how SAP enterprise data, AI decision engines, governance controls and operational action connect in a responsible decision-support model.

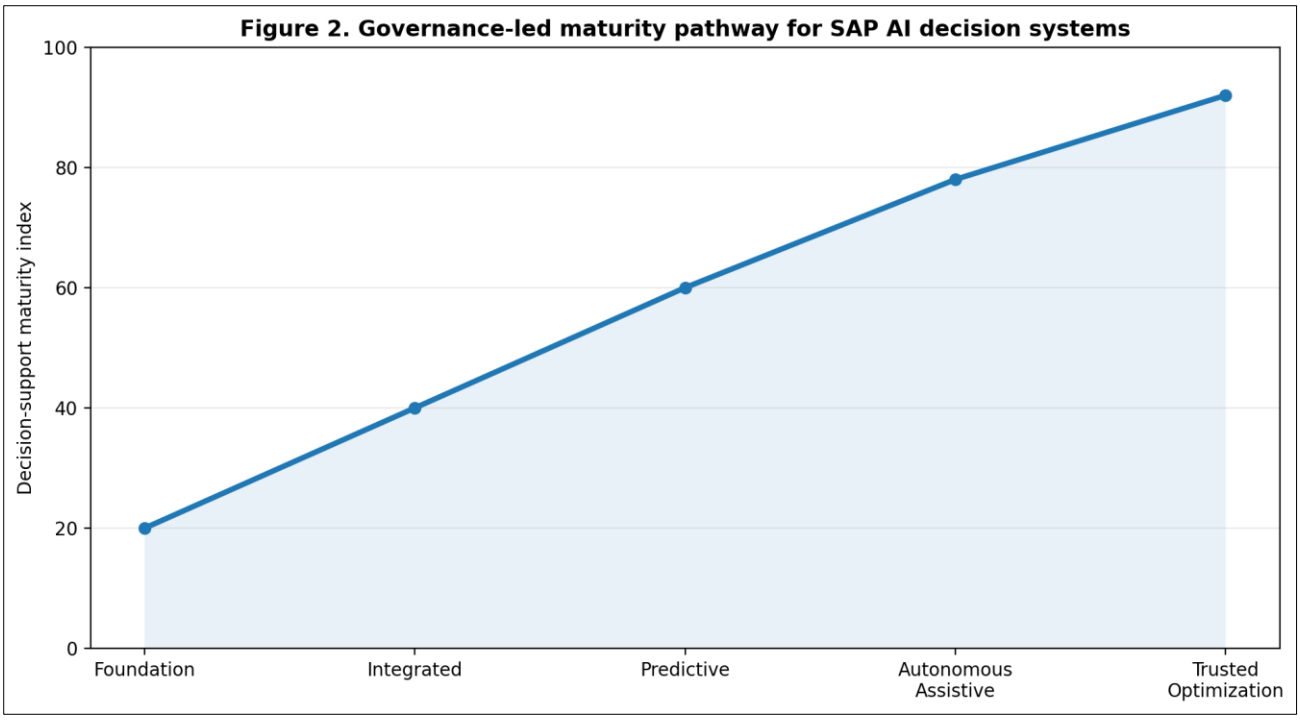

Figure 2: Apple-inspired maturity pathway for moving from foundational reporting to trusted optimization in SAP AI decision support

Table 1: Core AI use cases for SAP-based enterprise operations in Saudi Arabia

SAP Operation Area	AI Decision-Support Use Case	Expected Business Value	Vision 2030 Link
Procurement and supply chain	Supplier risk scoring, demand forecasting and inventory optimization	Lower stock-outs, better working capital and resilient sourcing	Industrial competitiveness and local supply-chain capability
Asset management	Predictive maintenance and anomaly detection	Higher asset availability and reduced unplanned downtime	Operational excellence in energy, utilities and manufacturing
Finance and controlling	Cash forecasting, cost variance alerts and fraud anomaly detection	Improved financial discipline and faster executive control	Transparent governance and efficient capital allocation
Project delivery	Schedule risk prediction and milestone exception dashboards	Improved project control for giga-projects and infrastructure	National transformation and infrastructure execution
Human capital	Workforce planning and skills-gap analytics	Better capacity planning and capability localization	Human capability development and knowledge economy

Table 2: Governance controls for responsible AI decision support in SAP environments

Governance Area	Control Requirement	Owner	Evidence / Audit Artifact
Data quality	Master data standards, lineage, cleansing rules and exception logs	Data owner and process owner	Data quality dashboard and lineage register
Model governance	Validation, drift monitoring, explainability and confidence thresholds	AI governance committee	Model card, test results and approval record
Cyber security and privacy	Role-based access, encryption, monitoring and privacy impact review	CISO, compliance and SAP security lead	Access matrix, risk assessment and audit trail
Human oversight	Approval workflows and override rules for medium and high-risk decisions	Business process owner	Workflow log and escalation record

Governance Area	Control Requirement	Owner	Evidence / Audit Artifact
Performance management	KPIs for accuracy, adoption, cycle time, cost and risk reduction	Transformation office	Benefits realization report

7. CONCLUSION

This review paper provides an understanding of the governance-based approach in the implementation of AI driven decision support system for SAP-based operation of enterprises in Saudi Arabia. The analysis reveals that AI will be more helpful for making decisions faster, accurately, and in terms of managing risks effectively and coordinating activities when AI is based on credible SAP data. Moreover, it is governed in the most effective manner. This paper proposes a six-level framework for implementing an AI-driven decision support system which includes data foundations, intelligence, workflow, governance, adoption, and vision for 2030.

Also, one should realize that there is no alternative to enterprise transformation skills when talking about adopting AI. There should be standard processes in place, proper data management, executive involvement, users' knowledge of the processes, cyber security measures, and business value as well. Enterprises in Saudi Arabia, which adopt an AI-based decision-making process via a maturity approach, can go from descriptive reports to predictions, assistance, and optimal decisions.

8. Limitations and Future Research

The paper relies on literature review, rather than primary data on surveying SAP users from Saudi Arabia. Future researchers need to test the proposed framework through case study examples for sectors such as energy, banking, logistics, health care, manufacturing, and giga-project delivery. The quantitative approach can be adopted to study how the data maturity level within an organization, degree of integration of AI and decision-making processes affect the performance of Saudi enterprises.

It is essential to conduct future research on the Arabic language user interface, national security regulations, sector-specific AI management practices, and the long-term effects of generative AI agents on decision roles in enterprise.

It is crucial to note the practical orientation of the paper since the enterprise decision support system should serve the needs of real managers working under constraints of time, regulation, and performance expectation. For Saudi organizations, the most effective way of implementing the value of AI initiatives is when they contribute to the improvement of measurable outcomes of an operation. According to the proposed model, the quality of data, ownership of processes, and human accountability become strategic factors in achieving managerial knowledge from advanced analytics techniques. It is crucial to note the practical orientation of the paper since the enterprise decision support system should serve the needs of real managers working under constraints of time, regulation, and performance expectation. For Saudi organizations, the most effective way of implementing the value of AI initiatives is when they contribute to the improvement of measurable outcomes of an operation. According to the proposed model, the quality of data, ownership of processes, and human accountability become strategic factors in achieving managerial knowledge from advanced analytics techniques. It is crucial to note the practical orientation of the paper since the enterprise decision support system should serve the needs of real managers working under constraints of time, regulation, and performance expectation. For Saudi organizations, the most effective way of implementing the value of AI initiatives is when they contribute to the improvement of measurable outcomes of an operation. According to the proposed model, the quality of data, ownership of processes, and human accountability become strategic factors in achieving managerial knowledge from advanced analytics techniques. It is crucial to note the practical orientation of the paper since the enterprise decision support system should serve the needs of real managers working under constraints of time, regulation, and performance expectation. For Saudi organizations, the most effective way of implementing the value of AI initiatives is when they contribute to the improvement of measurable outcomes of an operation. According to the proposed model, the quality of data, ownership of processes, and human accountability become strategic factors in achieving managerial knowledge from advanced analytics techniques. It is crucial to note the practical orientation of the paper since the enterprise decision support system should serve the needs of real managers working under constraints of time, regulation, and performance expectation. For Saudi organizations, the most effective way of implementing the value of AI initiatives is when they contribute to the improvement of measurable outcomes of an operation. According to the proposed model, the quality of data, ownership of processes, and human accountability become strategic factors in achieving managerial knowledge from advanced analytics techniques. It is crucial to note the practical orientation of the paper since the enterprise decision support system should serve the needs of real managers working under constraints of time, regulation, and performance expectation. For Saudi organizations, the most effective way of implementing the value of AI initiatives is when they contribute to the improvement of measurable outcomes of an operation. According to the proposed model, the quality of data, ownership of processes, and human accountability become strategic factors in achieving managerial knowledge from advanced analytics techniques. It is crucial to note the practical orientation of the paper since the enterprise decision support system should serve the needs of real

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