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# Driving Digital Transformation in the Oil and Gas Sector: Unlocking AI's Potential in the UAE


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# Driving Digital Transformation in the Oil and Gas Sector: Unlocking AI's Potential in the UAE


## Abstract

### Purpose

This study examines the implementation of artificial intelligence (AI) in the UAE oil and gas sector, focusing on operational, project management, and executive-level challenges. It addresses gaps in existing research, which predominantly originates from North America and Europe, and provides a regional perspective on the practical challenges of AI adoption. The study aims to guide future AI implementation projects in the UAE by offering a structured framework.

### Design/methodology/approach

A three-phase qualitative study was conducted using an interpretivist methodology. Semi-structured interviews were carried out with operational engineers, project managers, and senior executives in the UAE oil and gas sector. Data saturation was achieved, and thematic analysis was employed to interpret the findings.

### Findings

The study identifies the necessity of adopting a lessons-learned approach, reflecting the emerging stage of AI in the sector. It emphasises the importance of structured change management methodologies to address gaps in digital transformation research. Findings also highlight the critical need for collaborative efforts to bridge skill gaps and expertise, despite challenges posed by the sector's siloed organisational culture. Senior management support is identified as essential for fostering collaboration. A developed model was applied to an existing AI project and presented as a preliminary evaluation.

### Research implications

This study contributes to the literature on AI implementation by providing a region-specific perspective for the UAE oil and gas sector. It identifies key challenges and offers actionable recommendations for practitioners and researchers, highlighting the importance of structured change management and collaboration in overcoming barriers to AI adoption.

### Originality/value

This study presents a novel and impactful framework for implementing AI in the UAE oil and gas sector, effectively bridging both regional and practical research gaps. It highlights the critical importance of equipping engineers with the requisite skills to facilitate successful AI adoption and delivers a robust, practice-oriented model that can guide future initiatives and strategic decision-making within the industry.

**Keywords:** Artificial Intelligence (AI); change management; collaboration; oil and gas sector; project management; UAE.

## Introduction

Artificial intelligence (AI) is rapidly becoming a cornerstone of digital transformation in the oil and gas sector, offering significant potential to enhance operational efficiency, improve decision-making, and deliver value-added services (Arinze et al., 2024). Alongside technologies such as robotics and machine learning, AI has revolutionised the sector by enabling advanced data processing and predictive analytics (Al-Hajri et al., 2024). These technologies have helped organisations manage vast datasets and reduce reliance on subjective, experience-based decision-making (Hanson et al., 2023). However, AI adoption has been slow, owing to the substantial capital investment required, high perceived risks, and the entrenched perception of the industry as environmentally unsustainable. This hesitancy reflects broader challenges within the sector, including its siloed culture and reliance on specialised expertise (Gamal, 2025; Mohd-Shamsudin et al., 2024). In the UAE, AI adoption aligns with the government's AI Strategy 2031, which aims to optimise business operations and stakeholder experiences while driving financial returns (Crupi & Schilirò, 2023; Al Ali et al., 2023). Recent investments in digital transformation within the UAE's oil and gas sector demonstrate growing interest in AI and machine learning technologies, which hold promise for operational innovation and efficiency (Hadil et al., 2024). By optimising business processes, predicting maintenance needs, and reducing costs, these technologies have the potential to transform the industry (Ogbu et al., 2024). However, they also present significant challenges, including the need for advanced technical expertise, robust infrastructure, and regulatory compliance. Poorly implemented AI systems have already resulted in costly errors, underscoring the importance of careful planning and execution (Daramola et al., 2024; Khassawneh et al., 2024). Despite the clear benefits, AI implementation in the oil and gas sector remains fraught with challenges. The industry's longstanding reliance on human expertise and judgement conflicts with AI's potential to minimise human intervention (Oriji et al., 2023). This tension has raised concerns around job displacement and skills gaps, further complicating adoption. Moreover, while the global discourse on AI often centres on its technical applications, there is a notable gap in understanding how to manage AI projects effectively within the oil and gas context. Existing research has largely neglected the operational and project management complexities of AI adoption—especially within the UAE's unique regulatory and infrastructural landscape (Kadom & Kader, 2021).

To address this gap, the study sets out to achieve the following objectives:

- Critically evaluate operational management approaches to AI implementation in the UAE oil and gas sector;
- Identify and assess the benefits and efficiencies gained from AI in exploration and production activities;
- Analyse the managerial challenges associated with AI adoption within the sector; and
- Develop a transformational model to guide the effective implementation of AI in future initiatives.

By addressing these objectives, the study contributes to a deeper understanding of how AI can be effectively integrated into the oil and gas industry, offering both theoretical insights and practical solutions for overcoming adoption barriers. Figure 1 presents the conceptual model of the study.

**Insert Figure 1 Here**

## Literature Review

### *Theoretical Foundations and Framework Integration*

This study contributes to a deeper understanding of AI adoption in the oil and gas sector by proposing a cross-tier framework that bridges strategic, project-level, and operational insights (Chowdhury et al., 2023; Hanson et al., 2023). The findings demonstrate that AI implementation is not solely a technical challenge but a multidimensional transformation involving leadership commitment, regulatory compliance, workforce readiness, and legacy system integration (Koroteev & Tekic, 2021; Abu-AlSondos et al., 2024). These challenges are compounded by region-specific factors unique to the Gulf and Middle East, which existing global models frequently overlook (Al-Hajri et al., 2024). A key insight emerging from this study is the role of national compliance requirements in shaping digital transformation. In the UAE, strict data localisation laws—enforced by the Telecommunications and Digital Government Regulatory Authority (TDRA)—significantly influence decisions related to cloud computing and data architecture (Xanthidis et al., 2019; Almarashda et al., 2023). Senior managers emphasised that while cloud solutions offer scalability, they are often underutilised due to legal constraints (Toufaily & Zalan, 2023). This contrasts with neighbouring Saudi Arabia, where national-scale initiatives such as NEOM and Aramco's AI and digital twin programmes benefit from extensive state-backed infrastructure investments, allowing for wider integration of global AI technologies (Al Ghamdi et al., 2022; Crupi & Schilirò, 2023). Similarly, Qatar's hydrocarbon sector, with strategic investments in predictive analytics across its LNG supply chain, showcases a more targeted application of AI to optimise logistics and distribution (Abu-AlSondos et al., 2024; Li et al., 2023). These country-level comparisons underscore that while technical solutions may be transferable, institutional and policy ecosystems fundamentally shape implementation pathways. The UAE's cautious stance, driven by national cybersecurity priorities and regulatory oversight, necessitates hybrid models that support both innovation and compliance (Xanthidis et al., 2019; Al Dhaif et al., 2022). Another notable contrast is seen in Iran, where the government's regulatory framework prioritises centralised data sovereignty, especially within state-owned petrochemical firms. While this limits collaboration with international AI vendors, it fosters domestic AI development under state control (Al-Hajri et al., 2024). In contrast, the UAE's strategy blends selective global partnerships with a strong emphasis on national talent development, as embodied in the AI Strategy 2031 (Crupi & Schilirò, 2023). However, this hybrid approach can create operational inconsistencies, as different departments within the same organisation may adopt divergent tools and practices due to the absence of a unified AI governance framework. Internally, the findings reaffirm existing literature on workforce capability gaps and siloed operations (Satipaldy et al., 2021; Salhab et al., 2023), while extending these discussions through a sector-specific lens. Participants highlighted a persistent disconnect between technical experts (e.g., data scientists) and domain specialists (e.g., reservoir engineers), which impedes effective model deployment and feedback loops (Rajguru, 2024). While previous research has identified such misalignments (Abdulmuhsin et al., 2024), this study's three-phase design reveals how these challenges are perceived differently across organisational tiers, suggesting the need for more dynamic cross-functional collaboration mechanisms. The study also introduces new insights into the (non-)institutionalisation of lessons learned within AI initiatives. Unlike physical infrastructure projects, AI projects require iterative learning cycles. However, participants reported an absence of systematic mechanisms to capture and transfer implementation knowledge (Carrillo et al., 2013; Paver & Duffield, 2019). Although some project managers experimented with agile methodologies, their efforts were often constrained by rigid, top-down bureaucratic structures. This highlights the necessity of hybrid change management approaches that balance flexibility with procedural rigour—something not fully addressed in global standards such as ITIL (Gërvalla et al., 2018; Hornstein, 2015). From a strategic perspective, while global literature stresses the importance of executive sponsorship in AI initiatives (Burke, 2013; Kohli & Johnson, 2011), this study finds that leadership engagement in the UAE tends to be reactive rather than proactive. Executives often support AI projects only after initial success is demonstrated, rather than championing early experimentation. This behaviour contrasts with leadership at Saudi Arabia's Aramco, where executives actively sponsor AI centres of excellence and promote AI maturity models across the organisation (Al Ghamdi et al., 2022; Gamal, 2025; Jia, 2024).

***Lessons Learned and Operational Challenges***

Organisational learning theory (Argyris & Schön, 1978) highlights that sustained performance improvement arises not merely from technological adoption but from an organisation's capacity to learn from its experiences and adjust behaviour accordingly. Within the oil and gas sector, the implementation of AI technologies such as predictive maintenance systems, real-time exploration analytics, and intelligent drilling optimisation is particularly dependent on the ability to learn from past initiatives (Eltweri et al., 2021). Unlike one-off IT deployments, AI systems require continuous refinement, model retraining, and system integration, often in environments characterised by legacy infrastructure and conservative operational cultures. However, empirical evidence suggests that oil and gas firms often struggle to systematically document and apply lessons learned from digital transformation efforts, particularly in AI-specific contexts. The lessons-learned methodology, though widely endorsed in traditional project management literature, remains underutilised in the context of digital innovation. Rajguru (2024) identifies a recurring pattern of fragmented knowledge retention in AI initiatives, where project insights are siloed, tacit, or lost with team turnover. This creates significant operational inefficiencies, as organisations frequently repeat avoidable mistakes—ranging from flawed data pre-processing to resistance from frontline staff during deployment phases. Critically, Abu-AlSondos et al. (2024) argue that digital transformation requires not only technical agility but also a proactive operational culture that embraces failure as a source of innovation. Their findings underscore that organisations which treat AI initiatives as isolated technical upgrades, rather than iterative learning opportunities, are more likely to encounter breakdowns in workflow integration and underperformance in AI-driven solutions. This observation aligns with Kalantzakos (2020), who stresses that AI projects—unlike conventional digital tools—demand dynamic feedback loops where insights from failed model runs or inaccurate predictions are not discarded but systematically analysed and fed back into process improvements. Yet, such feedback loops are rarely formalised in the sector. Moreover, Shahbaz et al. (2022) caution that without formal institutional mechanisms for learning, including documentation protocols, after-action reviews, and cross-functional debriefs, the organisational memory needed to support scalable AI deployment remains weak. This poses a direct threat to operational continuity, especially in high-risk, high-investment environments such as offshore drilling or pipeline management, where the cost of failure is amplified. The absence of a strong lessons-learned infrastructure can lead to misalignment between AI developers and operational users, further exacerbating implementation friction and system underutilisation. Another critical yet underexamined issue is the gap between technical project outcomes and the experiential knowledge of on-the-ground teams. Many oil and gas companies lack a mechanism to reconcile project metrics (e.g., AI model accuracy, reduced downtime) with practitioner narratives that could illuminate hidden inefficiencies, workarounds, or unanticipated resistance points. Bridging this gap requires not only investment in digital tools for capturing operational insights but also leadership commitment to cultivating a culture of learning and reflection. As Valtakoski and Järvi (2016) note, knowledge reuse is unlikely to occur without deliberate strategies to institutionalise it.

***Monetary Value and Project Management Decisions***

Understanding the monetary value of AI adoption is critical for managing complex technology projects in the oil and gas sector. Economic theory and the resource-based view (RBV) (Barney, 1991) provide foundational insights into how firms leverage strategic resources—such as data assets and technological infrastructure—for long-term competitive advantage. Within this framework, project managers are not only responsible for evaluating the immediate financial costs of AI implementation, but also for justifying these expenditures in the face of uncertain and often intangible returns. One of the most significant challenges in this domain is that conventional evaluation tools—such as return on investment (ROI), net present value (NPV), and internal rate of return (IRR)—frequently fall short when applied to AI projects. These traditional methods struggle to account for the long-term, indirect, and cumulative nature of AI benefits, such as operational resilience, strategic agility, and predictive capabilities. For example, an AI system designed to reduce downtime through predictive maintenance may yield substantial benefits over time, yet these gains may not be immediately visible or easily quantifiable during the initial budgeting phase. As Chowdhury et al. (2023) argue, a multidimensional approach that incorporates both financial indicators and qualitative assessments—such as improved decision-making, team collaboration, and risk mitigation—is essential to capturing the full value of AI. Moreover, the oil and gas sector presents specific project management complexities that heighten the relevance of these concerns. Projects in this industry are capital-intensive, long-term, and susceptible to global price volatility, which exacerbates risk aversion and resistance to non-essential expenditures. In such contexts, AI investments are often viewed as speculative unless their value can be clearly demonstrated. This creates a tension between long-term digital transformation goals and short-term financial accountability, forcing project managers to navigate competing priorities and justify innovation through often inadequate financial narratives. Alkhwaldi (2024) contributes to this discussion by examining fintech adoption through the lens of financial literacy and quality of life, suggesting that monetary value extends beyond economic gain to encompass broader measures of well-being and decision-making efficacy. This perspective is particularly relevant in oil and gas, where AI implementation can reduce not only costs but also employee workload, operational stress, and accident risk—benefits that contribute to organisational health but are difficult to monetise. The implication here is that project valuation models must evolve to account for the socio-technical nature of AI initiatives, especially in high-risk environments. Furthermore, Abdulmuhsin et al. (2024) emphasise the synergy between AI and knowledge management as a driver of proactive green innovation and long-term sustainability. Their findings underscore that monetary value in the digital age is increasingly tied to knowledge assets and learning capacity—both of which require strategic investment and cannot be fully captured through static financial models. For project managers, this implies the need to align resource planning not only with technical deliverables but also with capabilities for knowledge generation and innovation. Yet, many oil and gas firms still lack integrated budgeting models that combine AI infrastructure costs with investment in human capital, change management, and ecosystem partnerships. In practice, the underestimation of AI's value often leads to underinvestment, project scaling delays, or early termination—outcomes that reflect more on flawed valuation methodologies than on the technology itself. As a result, some firms opt for incremental pilots or vendor-driven projects that minimise perceived risk but fail to yield transformational benefits. To counter this, organisations must develop robust, context-sensitive valuation frameworks that factor in both tangible cost savings and intangible strategic gains. These frameworks should include scenario-based modelling, sensitivity analysis, and long-term performance tracking to better capture the evolving return on AI investment over time.

### *External Factors and Executive-Level Strategy*

nstitutional theory (DiMaggio & Powell, 1983) offers a critical framework for analysing how external pressures—including regulatory mandates, technological infrastructure limitations, and global competitive forces—constrain and shape executive-level decision-making. In highly regulated environments such as the UAE, strategic leadership in the oil and gas sector is deeply influenced by institutional norms and state-imposed directives. While AI presents opportunities for transformative gains, these benefits are often moderated by formal structures, such as national digital strategies, legal compliance frameworks, and data governance requirements. The UAE's AI Strategy 2031, for instance, has positioned the country as a regional leader in digital transformation. However, this ambitious vision simultaneously imposes top-down pressures on executive teams to rapidly adopt and integrate AI technologies. These mandates coexist with stringent data localisation laws and cybersecurity standards that complicate the deployment of scalable, cloud-based AI solutions (Toufaily et al., 2023). As a result, executives are often caught in a paradox: they must demonstrate innovation and responsiveness to national priorities while managing the operational risks of non-compliance and infrastructural unpreparedness. Shehadeh et al. (2023) provide empirical support for the argument that digital transformation, while enhancing operational efficiency and competitiveness, is not a neutral process. It is embedded in institutional structures that both enable and constrain organisational agency. Their research in Islamic banking—a sector with similarly high levels of regulation and complexity—reveals how executive leadership must negotiate between compliance demands and strategic innovation. This finding resonates with the oil and gas context, where compliance with government initiatives and sector-specific safety standards often dictates the scope, timing, and form of AI adoption. Almarashda et al. (2023) add further nuance by emphasising the risks of overdependence on external vendors and the technical limitations of existing IT infrastructure. These constraints are particularly relevant in oil and gas, where AI solutions often require massive data processing capabilities and real-time analytics that are difficult to achieve without modernised infrastructure. Executives face difficult trade-offs between adopting advanced technologies and ensuring data security, operational continuity, and regulatory conformity. Such tensions are exacerbated in strategic projects involving foreign technology partners, where jurisdictional differences in data privacy laws and IP rights create additional governance challenges. Abu-AlSondos et al. (2024) reinforce the view that the success of digital transformation initiatives depends heavily on institutional readiness and policy coherence. Their findings suggest that when policy signals are vague or conflicting—as can occur when economic liberalisation and digital protectionism coexist—executives encounter strategic ambiguity, which hinders decision-making and delays implementation. Moreover, policy frameworks often lack the granularity needed for sector-specific execution, leaving executive teams to interpret and operationalise national strategies in an ad hoc or overly cautious manner. This institutional ambiguity can result in superficial adoption of AI (e.g., pilot projects or technology showcases) without meaningful integration into core operations. Critically, many executive teams lack the organisational agility and cross-functional coordination needed to respond effectively to institutional pressures. In such settings, AI adoption is often relegated to the IT department or treated as a compliance exercise, rather than a transformative strategic initiative. This limits the ability of firms to achieve alignment between institutional expectations and internal capabilities. As a result, executives must not only manage technological risk, but also build internal structures—such as digital governance boards and regulatory liaison roles—that can proactively address evolving external demands.

***Expertise and Skills Across Organizational Levels***

Human capital theory (Strober, 1990) underlines that knowledge, skills, and abilities embedded in the workforce are not only economic assets but also key enablers of innovation and competitive advantage. In the context of AI implementation, particularly within the technically complex and risk-sensitive oil and gas sector, the availability of skilled human capital is a decisive factor in determining project success. Yet, despite growing investments in digital infrastructure, many oil and gas firms remain critically underprepared in terms of workforce readiness for AI-driven transformation. AI projects require collaboration across multiple disciplines, involving not only data scientists and software engineers but also geoscientists, operations managers, and IT professionals. This interdependence introduces unique challenges in industries such as oil and gas, where organisational structures remain deeply siloed and traditionally resistant to cross-functional collaboration. The limited presence of integrated teams hampers knowledge exchange and slows the pace of digital learning across departments. As a result, many AI deployments fail, not because of technological shortcomings, but due to organisational inertia and a lack of interdisciplinary synergy. Salhab et al. (2023) and Bourezg et al. (2025) demonstrate that AI-enabled decision-making in digitally mature supply chains relies on a workforce capable of understanding and applying analytical outputs in real time. While their findings pertain to broader supply chain contexts, the parallels with oil and gas are striking. In both cases, the effectiveness of AI tools hinges on employees' ability to interpret, contextualise, and act on data-driven insights. When employees lack such skills, or are excluded from the AI implementation process, technological adoption tends to be superficial or misaligned with operational needs. The talent gap in the oil and gas sector is further exacerbated by global competition for AI expertise. Skilled professionals with competencies in machine learning, algorithm design, and data engineering are more likely to be drawn to high-tech or finance sectors that offer greater career development, digital maturity, and a culture of innovation. This makes it increasingly difficult for oil and gas firms to attract and retain top talent, particularly when internal environments are perceived as static or risk-averse. Moreover, the sector's overreliance on legacy expertise, while valuable for conventional operations, does not readily translate into the agile mindsets required for AI innovation. Abdulmuhsin et al. (2024) and Al-Ali et al. (2025) expand the conversation by emphasising that technical expertise alone is insufficient. Trust, shared values, and a sustainability-oriented mindset are equally crucial for the success of AI projects. This perspective implies that workforce development must extend beyond technical training to include cultural transformation. Employees need to understand not only how to use AI tools but also why they matter, how they align with organisational strategy, environmental goals, and long-term industry viability. Without such alignment, resistance to change is likely to persist and strategic AI objectives may be undermined. The organisational response to these challenges has been uneven. While some firms have launched isolated training initiatives or outsourced AI development to external vendors, these approaches often lack strategic depth and fail to build internal capabilities. Chowdhury et al. (2023) and Darwish et al. (2024) argue for the necessity of institutional partnerships, such as collaborations with universities, research centres, and technology incubators, as a more sustainable pathway to skills development. In addition, internal upskilling platforms, including AI academies, mentorship programmes, and cross-training modules, can help organisations nurture homegrown talent tailored to their specific operational contexts. Yet even these interventions are insufficient without structural changes. A critical barrier to skills integration is the absence of clear role definitions and career pathways for AI-related positions within oil and gas firms. Titles such as 'AI Product Manager' or 'Machine Learning Operations Engineer' often lack formal recognition, leading to confusion, redundancy, and limited accountability. Redesigning job roles, redefining performance metrics, and aligning incentives with digital competencies are essential steps in embedding AI expertise throughout the organisation. Overall, the literature reviewed reveals that AI adoption in the UAE oil and gas sector is a multifaceted phenomenon shaped by a dynamic interplay of internal capabilities and external pressures. Each of the four theoretical themes—lessons learned, monetary value, external factors, and expertise and skills—addresses a distinct but interdependent dimension of the implementation landscape. Lessons learned contribute to operational readiness by enabling organisations to refine workflows and reduce avoidable disruptions. Monetary value frames the financial rationale for AI projects and underpins project management decision-making in a sector marked by capital intensity and risk sensitivity. External factors shape executive-level strategies through regulatory mandates, policy signals, and infrastructural constraints. Expertise and skills, meanwhile, determine whether organisations can internalise, scale, and sustain AI solutions over time (Khassawneh & Darwish, 2024). Critically, these dimensions are not isolated. They intersect in ways that can either reinforce or undermine the success of AI initiatives. For instance, a lack of organisational learning mechanisms, such as lessons learned, can distort project valuation models and result in overinvestment in unscalable technologies or underinvestment in promising solutions. Similarly, regulatory uncertainty may discourage investment in AI infrastructure unless executives are supported by cross-functional teams with the capacity to adapt implementation strategies in real time (Mohammad et al., 2024). The failure to integrate these dimensions holistically often results in pilot fatigue, implementation delays, or strategic misalignment. These are outcomes that have already been observed in various digital transformation efforts in the UAE energy sector. Ultimately, this review reinforces the importance of viewing AI implementation not as a purely technical challenge but as a strategic transformation, deeply embedded in the organisational and institutional fabric. Only by integrating these four thematic lenses can organisations in the UAE oil and gas sector unlock the full potential of AI to enhance resilience, performance, and long-term sustainability.

## Methodology

This study adopts a qualitative research design informed by a constructivist ontology and interpretivist epistemology, both of which are well suited to exploring complex, context-specific phenomena such as AI implementation in the oil and gas sector. This approach emphasises the co-construction of meaning through participants' experiences and is particularly appropriate for capturing the depth and nuance of digital transformation processes in a highly specialised and regulated industry (Cunliffe, 2011; Alharahsheh & Pius, 2020).

### *Research Design and Rationale*

Given the study's objective to explore the multi-level challenges and perceptions surrounding AI implementation in the UAE oil and gas sector, a purely qualitative approach was selected instead of a mixed-methods design. The research aims to access the subjective perspectives of stakeholders across operational, managerial, and executive levels. These perspectives are best captured through open-ended, context-rich inquiry. Quantitative measures alone would be insufficient to uncover the layered organisational dynamics, resistance, or tacit knowledge that often shape AI initiatives (Gioia, Corley, & Hamilton, 2013).

### *Multi-Phase Data Collection Strategy*

To achieve a comprehensive understanding, the study employed a three-phase design targeting distinct organizational tiers:

- **Phase 1:** Operational staff were interviewed to examine the impact of AI on daily work routines, system usability, and process integration.
- **Phase 2:** Project managers provided insights into the challenges of planning, resourcing, and coordinating AI implementation across teams.
- **Phase 3:** Senior executives reflected on the strategic alignment of AI with business goals and national policy frameworks such as the UAE's AI Strategy 2031.

This phased approach enabled the triangulation of perspectives and allowed insights from earlier phases to inform and refine later interviews. For instance, issues related to resistance and training identified in Phase 1 were further explored with managers in Phase 2 to assess organizational responses.

### *Participant Selection and Profiles*

A purposive sampling strategy (Patton, 2002) was used to select participants with direct experience in AI projects in the UAE oil and gas sector. Inclusion criteria required at least five years of industry experience and current involvement in AI-related initiatives. A total of 18 individuals were interviewed across the three phases, representing diverse roles in upstream and downstream operations.

Table 1 provides an overview of participants' roles, areas of expertise, and responsibilities. Participants were involved in projects such as:

- Predictive maintenance through machine learning models;
- AI-powered cognitive reservoir management;
- Digital drilling automation;
- Development of real-time analytics platforms;
- Integration of AI with sustainability metrics.

**Insert Table 1 Here**

***Data Collection Procedures***

Data were collected through semi-structured interviews, selected for their flexibility and capacity to elicit rich, in-depth narratives. The interview protocol was informed by the literature and refined through a pilot study, which tested the clarity and relevance of the questions (Kallio et al., 2016). Feedback from the pilot led to revisions, including the use of more open-ended prompts and greater sensitivity to contextual factors. Interviews were conducted in English, audio-recorded with participant consent, and transcribed verbatim. They lasted between 30 and 90 minutes, depending on the participant's availability. All interviews took place in private settings to encourage openness, and participants were assured of confidentiality and their right to withdraw at any stage (Bell & Bryman, 2007).

***Data Analysis***

A thematic analysis approach was employed to systematically identify, analyse, and interpret patterns within the data, following Braun and Clarke's (2006) six-step framework. The process began with familiarisation, during which the researchers reviewed the transcripts multiple times to become deeply immersed in the data. This was followed by initial coding, where line-by-line manual coding was conducted to extract meaningful units of text. These codes were then consolidated into a structured codebook, which was refined iteratively across the dataset to ensure consistency. Next, related codes were grouped into overarching themes that aligned with the study's conceptual framework, specifically focusing on lessons learned, monetary value, external factors, and expertise or skills. These themes were subsequently reviewed and refined across participant groups to ensure both consistency and conceptual clarity. Finally, the reporting phase involved selecting illustrative quotes and interpreting the findings in relation to the research objectives. To support transparency and analytical rigour, NVivo software was employed not as a validation tool, but as an organisational aid. NVivo facilitated cross-checking of manual codes, visualisation of co-occurrence patterns, and efficient retrieval of coded data for triangulation. This combined manual and digital coding strategy enhanced the consistency and reliability of the analysis. Following Lincoln and Guba's (1985) criteria, multiple strategies were adopted to ensure the trustworthiness of the study. Credibility was established through triangulation across three participant groups, as well as member checking, whereby participants reviewed their transcripts and provided feedback on the researchers' interpretations. To ensure dependability, a detailed audit trail was maintained, documenting key research decisions, the coding process, and the development of themes (Nowell et al., 2017). Transferability was strengthened by providing rich contextual descriptions of participants' roles and projects, allowing readers to assess the applicability of the findings to similar settings. Finally, confirmability was supported through reflexive journalling and collaborative coding sessions, both of which helped to mitigate researcher bias. Ethical research standards were upheld throughout the study. Informed consent was obtained from all participants, who were provided with detailed information about the study's purpose and procedures. Confidentiality and anonymity were guaranteed, and data were stored securely in accordance with institutional research ethics protocols.

## Results

his section presents the empirical findings of the study, structured around the four core themes derived from the conceptual model: Lessons Learned, Monetary Value, External Factors, and Expertise and Skills. These findings are reported across the three phases of data collection: operational staff (Phase 1), project managers (Phase 2), and senior executives (Phase 3). Supporting quotes from participants are included to represent authentic voices.

### ***Phase One: Insights from Operational Staff***

#### *Theme 1: Lessons Learned*

Operational staff emphasized the importance of documenting lessons learned throughout the project lifecycle rather than treating them as an afterthought. This reflection promoted proactive stakeholder engagement, improved planning, and supported scalability.

- *"The pilot phase plays a crucial role in fostering the commitment of key stakeholders… which lays the foundation for a well-structured and efficient implementation."* (Participant 6)
- *"Lessons learned from previous projects provide invaluable insights… ensuring that the project is both scalable and sustainable in the long term."* (Participant 5)

Participants also supported hybrid project management approaches that integrate agile feedback loops with traditional milestone tracking:

- *"I integrate best practices from both agile and waterfall methodologies… balancing flexibility with thorough planning, risk management, and delivery excellence."* (Participant 4)

*Theme 2: Monetary Value*

AI was consistently described as an enabler of enhanced decision-making and cost efficiency.

- *"AI facilitates the efficient creation of diverse scenarios… aligning operations with production and profitability objectives."* (Participant 2)
- *"AI unlocks missing data… significantly enhances modeling accuracy."* (Participant 6)

Despite this, some noted barriers in demonstrating ROI due to high initial costs and strict local data regulations:

- *"Cloud technology offers substantial value… but UAE regulations mandate that sensitive data be housed within the country."* (Participant 1)

*Theme 3: External Factors*

External institutional and ethical influences, such as COP28 and cybersecurity compliance, were highlighted.

- *"AI must prioritize sustainability… optimizing energy usage and reducing carbon footprints."* (Participant 7)

- *"IT security must be a top priority… with robust governance frameworks to manage third-party cloud risks."*(Participant 6)

*Theme 4: Expertise and Skills*

Participants emphasized the need for AI fluency among engineers and operational staff.

- *"The mindset of end-users must shift… to effectively apply AI-generated insights."* (Participant 3)
- *"Engineers must develop a clear understanding of how AI-generated data can enhance performance."* (Participant 5)

**Insert Table 2 Here**

***Phase Two: Insights from Project Managers***

Project managers ranked five themes—Strategy, Data, People, Process, and Technology—based on their importance during AI project execution. Rankings were collected in Excel (Table 3), and perceived gaps across the project lifecycle were visualized (Figure 2).

*Key Findings:*

- Project Managers 1 and 4 ranked Data Readiness highest, citing data cleansing challenges.
- Project Managers 2 and 3 prioritized Strategic Leadership, linking it to performance KPIs and long-term vision.
- Process optimization and collaboration were commonly underemphasized, revealing silos in project implementation.
- People and Skills were rated mid-importance but acknowledged as essential for bridging technical and operational workflows.

Direct quotes support these themes:

- *"Insufficient or low-quality data was frequently highlighted… leading to flawed models."* (Project Manager 1)

- *"Without clear and sustained commitment from senior management… AI initiatives often struggle."* (Project Manager 3)
- *"The inclusion of geologists and engineers alongside AI specialists… allows us to translate technical insights into actionable strategies."* (Project Manager 2)
- *"AI significantly reduces human effort… allowing teams to focus on higher-value tasks."* (Project Manager 4)

**Insert Table 3 Here**

**Insert Figure 2 Here**

Within this theme, 'leadership' commitment emerged as a key factor. Project Manager 3 noted:

*"The absence of consistent leadership support was identified as a significant barrier to AI adoption, impeding progress and misaligning efforts with long-term strategic goals. Participants noted that without clear and sustained commitment from senior management, AI initiatives often struggle to secure the necessary resources and organizational buy-in. This lack of support creates a fragmented approach, where teams operate without a unified vision or clear priorities. As one participant explained, 'Leadership must not only endorse AI but also actively champion its integration into our strategic roadmap.' Effective leadership is crucial to fostering a culture of innovation, securing stakeholder commitment, and ensuring alignment with broader organizational objectives."*

In addition, 'data readiness' has also been emerged within this phase. Data availability and quality were identified as foundational for AI workflows. Project Manager 1 observed:

*"Insufficient or low-quality data was frequently highlighted as a critical challenge disrupting AI modeling and limiting the feasibility of workflows. Participants emphasized that AI systems rely heavily on robust, accurate, and comprehensive datasets to function effectively. When data is incomplete, outdated, or inconsistent, it can lead to flawed models and unreliable predictions, ultimately diminishing the value of AI applications. As one participant remarked, 'The effectiveness of our AI projects depends entirely on the quality of data we feed into the*

*system; poor data results in poor outcomes.' Addressing this issue requires not only better data collection and management practices but also implementing rigorous data validation and cleansing protocols to ensure the reliability and integrity of datasets used in AI workflows."*

To address these issues, participants advocated for robust data governance and external partnerships for data acquisition (Koroteev & Tekic, 2021). Moreover, 'people and skills' also emerged as an important aspect. In other words, the need for skilled personnel was another critical theme. Project Manager 2 emphasized collaboration across disciplines:

*"Effective AI integration requires cross-functional collaboration, with teams comprising geologists, engineers, and AI specialists. This multidisciplinary approach fosters innovation by leveraging diverse expertise, ensuring that AI solutions align with industry-specific challenges and opportunities. As one participant noted, 'The inclusion of geologists and engineers alongside AI specialists allows us to translate technical insights into actionable strategies, driving both innovation and continuous development.' Such collaboration enables the creation of tailored AI models that enhance exploration accuracy, optimize resource extraction, and support sustainable operational practices. By bridging domain knowledge and technological expertise, organizations can ensure that AI implementations are not only technically robust but also strategically impactful."*

Finally, 'process optimization and technology integration' was also an important matter and discussed by the sampled participants; they stressed the importance of embedding AI into business processes to streamline workflows. Project Manager 4 highlighted the value of automation:

*"AI significantly reduces human effort and associated costs by automating complex tasks and streamlining workflows. As one participant noted, 'The integration of AI has enhanced process efficiency by minimizing manual interventions and allowing teams to focus on higher-value tasks.' This automation not only accelerates operational processes but also optimizes resource allocation, leading to measurable improvements in productivity and cost-effectiveness. By leveraging AI's capabilities, organizations can achieve more with fewer resources, paving the way for scalable and sustainable growth."*

However, inadequate training and poorly designed interfaces were identified as barriers to successful integration (Pargaonkar, 2023). In summary, the findings from phase 2, which involved four project managers and focused on themes emerging from phase 1, presented in an MS Excel spreadsheet. The interviews highlighted the critical role of strategic leadership and senior management commitment ('strategy'), emphasizing the need for senior leaders to act as dedicated digital advocates. Data readiness and usage ('data') emerged as another key theme, underscoring the importance of collecting, storing, and utilizing data effectively to inform and monitor AI acquisition strategies, mitigate risks, and align with organizational needs.

The theme of people and skills ('people') reflected the necessity for project managers and employees to possess advanced AI competencies and embrace innovative work practices. Process optimization ('process') emphasized moving away from siloed approaches toward greater collaboration, embedding AI into business processes, and simplifying existing systems. Finally, the implementation and integration of technology ('technology') focused on selecting AI solutions tailored to specific organizational goals, ensuring regular updates, and equipping teams with adequate training. These themes, depicted in Figure 3, collectively outline the essential elements for successful AI integration.

**Insert Figure 3 Here**

***Phase Three: Insights from Senior Executives***

Senior executives critiqued the emerging themes and emphasized their role in shaping long-term AI strategy.

- *"Any model or framework… needs to be all-inclusive and comprehensive… with a focus on economic benefits."*(Senior Manager 3)
- *"The model must capture the need for evaluating data quality… and tracking ROI through KPIs."* (Senior Manager 2)
- *"We need collaboration between data scientists and instructors… to achieve predictive maintenance."* (Senior Manager 1)

All senior managers stressed the need for long-term AI roadmaps, continued training, and partnerships with solution providers. Interestingly, none referenced **lessons learned** as a strategic tool—revealing a disconnect between operational and executive priorities.

**Insert Table 4 Here**

## Discussion and Conclusion

This study provides a multi-level analysis of AI implementation within the UAE oil and gas sector by integrating insights from operational staff, project managers, and senior executives. The findings reveal the interconnectedness of strategic leadership, data infrastructure, workforce capability, and cultural readiness in shaping the success of AI initiatives. While existing studies often examine technical or managerial aspects of AI adoption in isolation, this research advances the conversation by offering a holistic and context-sensitive framework tailored to the realities of a heavily regulated, capital-intensive industry. The research highlights the importance of aligning AI initiatives with strategic business goals, particularly in contexts where national data sovereignty laws and regulatory obligations impose significant constraints on implementation. Leadership engagement emerged as a central factor in guiding AI integration efforts and ensuring that innovation aligns with both operational performance and broader economic objectives. Moreover, the study reveals how limitations in internal skills and siloed organisational structures hinder collaboration between technical and domain experts, leading to poor coordination and limited scalability. It also demonstrates the pivotal role of data readiness, showing that fragmented legacy systems and restricted storage options undermine the accuracy and reliability of AI systems. Participants further identified a lack of structured change management as a key weakness, particularly in light of the cultural resistance often observed in the oil and gas workforce. Taken together, these findings underscore the need for adaptive leadership, targeted training, and inclusive strategies to manage technological disruption effectively.

### *Theoretical Implications*

This study contributes to theory in several key ways. First, it introduces a comprehensive AI implementation framework that integrates four core dimensions: strategy, data, people, and process, across three organisational levels: operational, managerial, and executive. In contrast to the linear or siloed models proposed in earlier studies, this framework provides a dynamic structure that reflects the iterative and cross-functional nature of AI projects. It extends traditional project management models by embedding AI-specific considerations, such as data governance, regulatory compliance, and continuous learning, within the broader context of digital transformation. Second, the study redefines the role of lessons learned in AI implementation. While the project management literature typically treats lessons learned as a retrospective tool, this research positions them as an ongoing and forward-looking mechanism. This perspective is essential for supporting iterative development and risk mitigation in AI projects. Such a reorientation adds nuance to existing theories of organisational learning and performance improvement, particularly within technologically complex environments. Third, the study broadens the theoretical understanding of AI adoption by emphasising regional and institutional influences. Conducted in the UAE, the research provides insight into how legal frameworks, cultural norms, and national economic strategies shape the nature and pace of digital innovation. This contextual emphasis complements global studies and addresses a notable gap in the literature on AI implementation in the Global South and in highly regulated, resource-driven sectors.

***Practical Implications***

The findings of this research offer clear, actionable guidance for organisations implementing AI in the oil and gas sector and other similarly structured industries. AI initiatives must be driven by strategic intent, with senior leaders visibly engaged in setting priorities, allocating resources, and linking AI deployment to business performance metrics. The Business Transformation Framework developed in this study provides a structured guide for organisations to assess readiness, align stakeholders, and monitor implementation progress over time. Addressing internal skills gaps is also critical. Organisations should develop internal training programmes to foster digital literacy among engineers, operators, and decision-makers. In parallel, partnerships with academic institutions and AI vendors can accelerate access to specialised expertise and support co-innovation. This dual approach to talent development can build a more adaptable workforce and reduce overreliance on external consultants. To ensure successful AI integration, organisations must invest in data readiness. This involves conducting system audits, consolidating disparate data sources, and ensuring compliance with local data storage regulations. Implementing robust governance frameworks will enhance both data quality and security, providing a solid foundation for trustworthy AI models. In addition, structured change management processes are essential. Employees must be informed, prepared, and actively involved throughout the transformation journey. Communication strategies should address fears surrounding job displacement and promote a culture of trust and transparency. Performance measurement tools, including real-time dashboards and tailored key performance indicators, should be developed to monitor AI-related outcomes. These metrics should go beyond cost savings to track improvements in decision-making speed, operational efficiency, and innovation outputs. This will enable organisations to recalibrate strategies as needed and to demonstrate the tangible value of AI over time.

### *Limitations and Future Directions*

While this study provides rich insights, several limitations should be acknowledged. The research is based on a single organisation within the UAE, which limits its generalisability. Although the qualitative approach enabled an in-depth exploration of the organisational dynamics surrounding AI implementation, it did not include quantitative analysis to measure actual performance outcomes. Furthermore, the study's regional focus means that findings related to regulatory compliance and institutional structures may not apply directly to organisations operating in other jurisdictions. Future research should test the proposed framework in other industries, such as healthcare, logistics, and manufacturing, to assess its adaptability and relevance. Comparative studies across different national contexts would help determine how institutional frameworks influence AI implementation outcomes. Quantitative studies incorporating surveys and performance data could also validate the framework's components and offer broader insights into critical success factors. Longitudinal research is needed to track the long-term effects of AI adoption on organisational learning, innovation, and performance. Additionally, ethical dimensions, including data privacy, algorithmic bias, and workforce displacement, warrant further investigation to support the development of responsible AI governance. In conclusion, this study offers a comprehensive and context-sensitive framework for understanding AI implementation in the UAE's oil and gas sector. By synthesising perspectives from multiple organisational tiers, it demonstrates that successful AI adoption is not merely a technical challenge, but also a strategic, cultural, and institutional endeavour. The findings contribute to both academic theory and managerial practice by presenting a dynamic model that reflects the complexities of deploying AI in a regulated, high-risk industry. For organisations seeking to leverage AI for digital transformation, this research provides both a conceptual foundation and a practical roadmap. The study emphasises that sustained success requires alignment across leadership, data, people, and processes, and that AI's full potential can only be realised through integrated and forward-looking implementation strategies.

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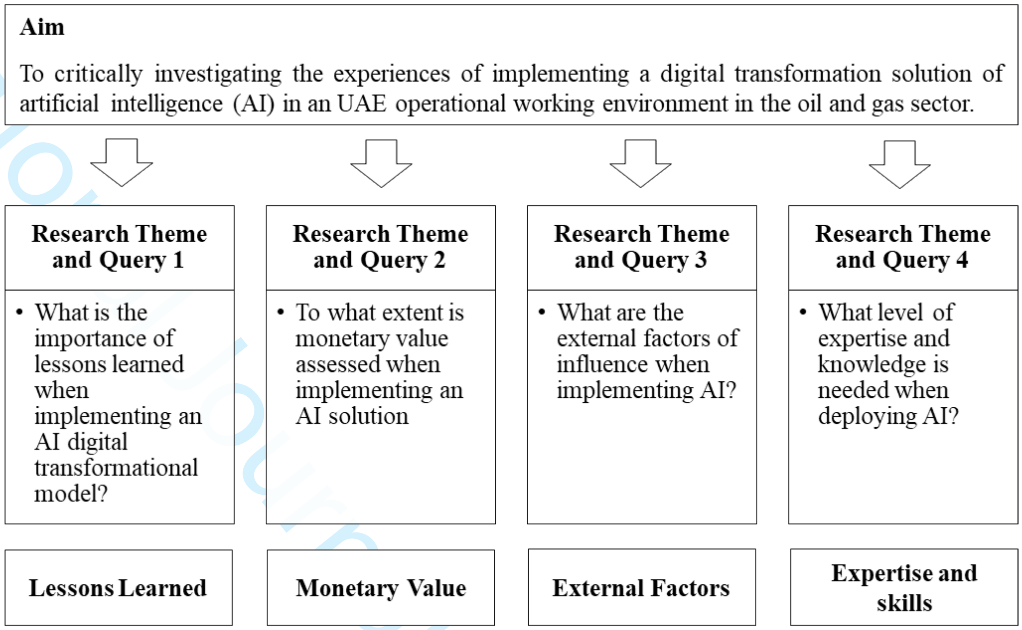


**Figure 1: Conceptual Model**

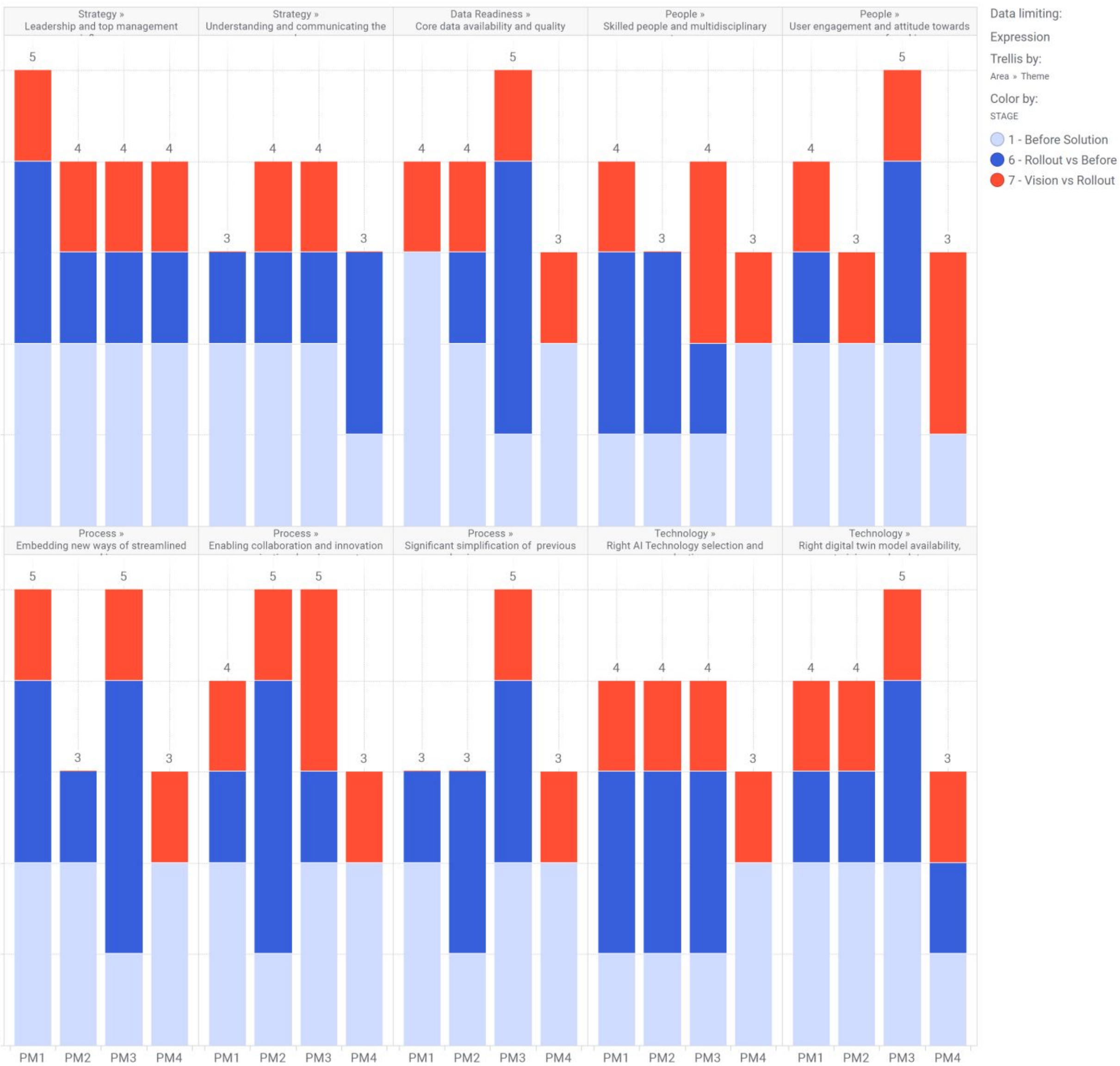


**Figure 1: Base line (Light blue), AI Contribution (Dark blue), and Gap (red).**

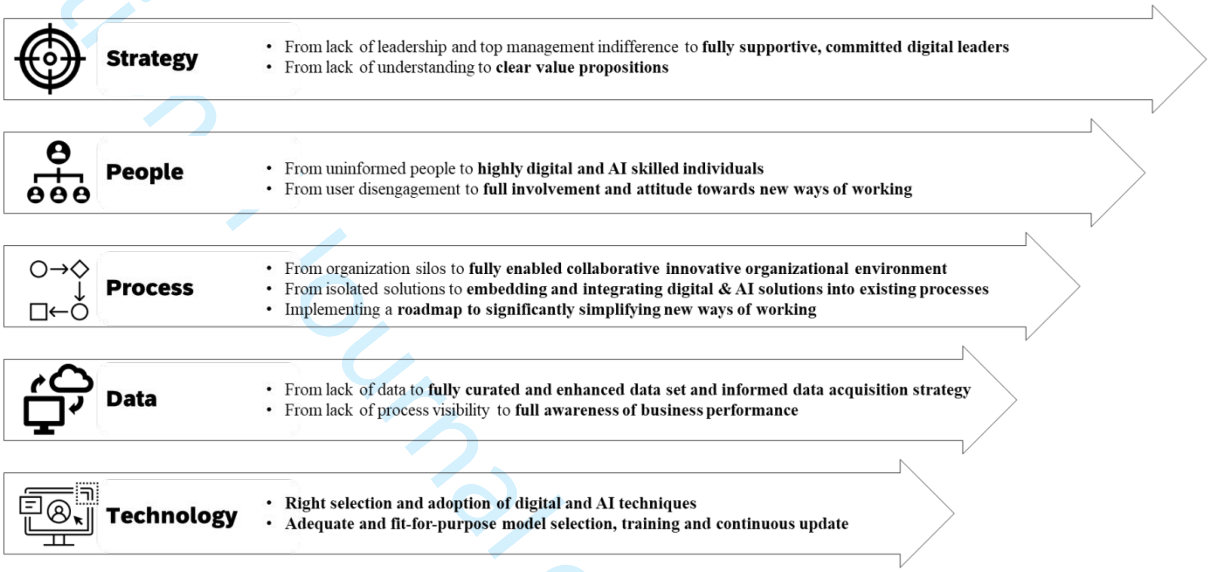


**Figure 2: Summary of Phase 2**

**Table 1 Participants Profile**

| **Participant code** | **Current role** | **Years of experience** | **Experience** | **Responsible for** |
|---|---|---|---|---|
| Participant 1 | Production and Reservoir Management Consulting Practice Manager | 25 | PE and RM | Production and reservoir and the implementation of AI process in production prediction of the solution |
| Participant 2 | Technology Strategy and Portfolio Manager | 18 | IT | Technology strategy planning & portfolio |
| Participant 3 | AI Program Manager; IT/Data scientist | 32 | PE, RM, IT and AI | Developing digital oilfield solutions |
| Participant 4 | AI Program Manager; IT/Data scientist | 16 | PE, RM, IT and AI | Developing digital oilfield solutions |
| Participant 5 | Data Scientist | 21 | PE, RM, and IT | Developing programs out of algorithms. Focus on sustainability. |
| Participant 6 | Specialist, Data Architecture | 21 | IT | Providing digital solutions for the Upstream Oil and Gas Industry |
| Participant 7 | Engineer, Research Experimental R & D: | 20 | PE, RM, IT and AI | Providing Technologies in exploration and production |
| Participant 8 | Business User | 16 | PE and RM | Using digital solution |
| Participant 9 | Product Manager | 20 | PE, IT and AI | Head of Digital Drilling Technologies at AIQ |
| Participant 10 | Principal Petroleum Engineering | 30 | IT and AI | Deploy digital oil Field solutions |
| Participant 11 | Senior Specialist Cognitive Reservoir Management | 30 | PE, RM, IT and AI | Cognitive Reservoir Management |
| Project Manager 1 | Project Manager | 10 | IT and AI | Leading digital project s and digital transformation |
| Project Manager 2 | Technical Project Manager | 20 | IT | Deploy digital solutions |

| | | | | |
|---|---|---|---|---|
| Project Manager 3 | Project Manager | 30 | IT and AI | Managing downstream digital project. |
| Project Manager 4 | Project Manager | 13 | IT | Managing upstream digital project |
| Senior Manager 1 | Production and Reservoir Management Consulting Global Director | 35 | PE, RM and AI | Development and management of the Production and Reservoir Management business |
| Senior Manager 2 | Software Company Chief Technology Officer | 15 | IT | Software applications that will help the business to achieve one business objective |
| Senior Manager 3 | Vice President, digital projects & Innovation | 20 | IT | Leading the Digital transformation journey and developing Digital strategies supporting the businesses |

Source: Interviews

**Table 2 Phase 1 to Phase 2 Themes Mapping activity**

| **Themes Generated from Phase One** | **Themes Generated from Phase Two** |
|---|---|
| Implementation of lessons learned | Data Readiness and Usage, People and skills, Strategic leadership, and senior management commitment |
| Monetary value | Strategic leadership and senior management commitment |
| External Factor | Implementation of technology and integration |
| Level of Knowledge | People and skills, Strategic leadership, and senior management commitment |
| Change Management | Implementation of technology and integration |

Source: Data Analysis

**Table 3 Outcomes of Project Managers**

| | Theme | Priority | Summary of the project manager's perspective |
|---|---|---|---|
| **Project Manager 1** | Strategic leadership and senior management commitment | 1 | Leadership and top management tend not to support business model transformation, and there is a lack of consistency. |
| | Data readiness and usage | 5 | High data availability and quality need to be achieved through continuous improvement processes, with the data being used for continuous improvement when applied to the AI business modelling. |
| | People and skills | 3 | The new AI solution simplifies previous complex processes and therefore assists the teams, but needs full informed involvement, to avoid confusion. |
| | Process and optimisation | 2 | There is increasing simplification of business processes and enhanced user knowledge of what used to be very complicated. At the same time, the outcomes should not be compromised. |
| | Implementation of technology and integration | 4 | New real-time data can be provided automatically and in real-time. |
| **Project Manager 2** | Strategic leadership and senior management commitment | 5 | Leadership and top management need to reward behaviour and results which are aligned with the overall long-term strategy. |
| | Data readiness and usage | 2 | Data needs to be readily available and of good quality without any inconsistencies. |
| | People and skills | 1 | Users and managers are not engaged during the solution-building process. Users and managers tend to be detractors of AI solutions and processes. There is a need for users to be involved with collaboration responsibilities. |

| | Theme | Priority | Summary of the project manager's perspective |
|---|---|---|---|
| | Process and optimisation | 4 | There is a need for permanent collaborative workflows and an innovation environment to be set up and designed to improve business performance monitoring. |
| | Implementation of technology and integration | 3 | Technology needs to be adaptable and linked to the existing processes and various resources, such as sensors and WCT meters. |
| **Project Manager 3** | Strategic leadership and senior management commitment | 5 | Key project owners need to be able to justify tangible (real) benefits including value tracking linked to finance and organisational outcomes |
| | Data readiness and usage | 4 | Data gaps need to be constantly monitored through acquiring new data, for example paying for third-party resources, installing new hardware, or establishing internal data governance processes to transform the existing business. |
| | People and skills | 3 | Users and managers need to be engaged at every stage of the design and solution. Users and manager support need to embrace the solutions and then understand the results generated by the AI tools. |
| | Process and optimisation | 1 | There is ad-hoc or no collaboration. Users perform workflows and run models in silos with individuals not sharing knowledge. Analysis results need to be disseminated accurately to users. |
| | Implementation of technology and integration | 2 | Automatic regulatory control of targets needs to be set up correctly. |
| **Project Manager 4** | Strategic leadership and senior management commitment | 4 | There is a need for good communication and awareness across all stakeholders from a strategic perspective. |

| | Theme | Priority | Summary of the project manager's perspective |
|---|---|---|---|
| | Data readiness and usage | 1 | Currently, data is poorly available, and quality is questionable for production optimisation. Poor data status limits the type of workflows which can be used to implement a business model transformation strategy. |
| | People and skills | 3 | There is a need for cohesive team activities with different expertise. Individual skills need to complement continuous development. |
| | Process and Optimisation | 2 | New ways of working need to be embedded in the business processes, but this is not fully understood. |
| | Implementation of technology and integration | 5 | AI could provide new insights which can help innovate and develop new business models and processes. |

Source: Data Analysis

**Table 4: Phase 2 to Phase 3 Mapping activity**

| **Themes generated from Phase One** | **Themes generated from Phase Two** | **Themes generated based on the outcomes of Phase Three** |
|---|---|---|
| Implementation of lessons learned | Data Readiness and Usage, People and skills, Strategic leadership, and senior management commitment | |
| Monetary value | Strategic leadership and senior management commitment | KPIs and the incorporation of ROI |
| External Factor | Implementation of technology and integration | Availability |
| Level of Knowledge | People and skills, Strategic leadership, and senior management commitment | Investment in specialism and on-going commitment are paramount. |
| Change Management | Implementation of technology and integration | Up-to-date technology and collaboration |

Source: Data Analysis