

Final Project 2

PMG 497

Project Template

Midocean University

Faculty of Management

Department/ Specialization



Project title

**The Impact of Digital Transformation on Project
Performance in the Oil and Gas Sector**

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Final Project - 2

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Acknowledgment

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Dedication

I dedicate this work to my beloved **family**, whose love and support have been the foundation of my strength. To my parents, who taught me the value of education and perseverance, and to everyone who believed in

me even when I doubted myself—this achievement is as much yours as it is mine.

Abstract

Purpose:

This research aims to explore the impact of digital transformation on project performance in the oil and gas sector, with a focus on Saudi Arabia. As the industry undergoes technological modernization, this study investigates how digital tools—such as AI, automation, and real-time data systems—affect key performance indicators including project delivery time, cost control, and quality standards.

Methodology:

A quantitative research approach will be adopted, utilizing a structured questionnaire distributed to professionals in the oil and gas sector, including project managers, engineers, and IT specialists. The data will be analyzed using statistical techniques to examine the relationships between digital transformation practices (independent variables) and project performance (dependent variable).

Findings:

While the study is still in progress, it is expected to reveal that digital transformation positively influences project performance, particularly in terms of time efficiency and quality improvements. However, organizational resistance and lack of technical readiness may limit the full potential of digital adoption.

Originality & Implication:

This research contributes to the limited empirical literature on digital transformation in oil and gas project management within the Gulf region. It provides a practical framework for companies to evaluate their digital strategies and supports project leaders in aligning technology with performance outcomes.

Keywords:

Digital transformation, project performance, oil and gas, Saudi Arabia, AI in project management, automation, digital innovation, project delivery, upstream operations, technological adoption.

Table of Contents

Acknowledgment	2
Dedication	3
Abstract	4
1. Chapter 1: Introduction	7
1.1. Research Background.....	8
1.2. Research Problem.....	9
1.2.1. Theoretical Gaps	9
1.2.2. Practical Gaps	9
1.3. Research Significance	9
1.3.1. At the theoretical level	9
1.3.2. At the practical level	9
1.4. Research Questions	10
1.5. Research Objectives	10
1.6. Research Hypotheses.....	10
1.7. Research Model.....	10
1.8. Scope of The Study	11
1.9. The Project Structure.....	11
2. Chapter 2: Literature Review	12
2.1. Introduction	12
2.2. The independent variable	13
2.3. The dependent variable	13
2.4. The relationship between the independent and the dependent variables	13

2.5.	Conclusion.....	13
3.	Chapter 3: Research Methodology	14
3.1.	Introduction	14
3.2.	Operational definitions for research variables	15
3.3.	Research design (research onion).....	15
3.4.	Research population & Sampling methods and technique	16
3.5.	Data collection method.....	16
3.6.	Types of data	16
3.7.	Statistical analysis procedures.....	17
3.8.	Conclusion.....	17
4.	Chapter 4: Statistical Analysis & Findings discussion.....	18
4.1.	Introduction	18
4.2.	Sample profile (descriptive statistics for research sample)	19
4.3.	Validity & reliability tests for the questionnaires	19
4.4.	Descriptive statistics for research variables (answer research questions).....	19
4.5.	Testing Hypotheses & Findings Discussion.....	20
4.6.	Conclusion.....	20
5.	Chapter five: Research limitations, Recommendations & Conclusion	21
5.1.	Research Limitations & Future Research.....	21
5.2.	Research Recommendations	22
	References.....	22
	Appendix.....	23

List of Figures:

List of Tables:

1. Chapter 1: Introduction

1.1. Research Background

In the past two decades, the concept of digital transformation has become a central theme across industries, reshaping how organizations operate, deliver services, and compete. In the energy sector, particularly oil and gas, the stakes are exceptionally high. This sector is characterized by complex operations, high capital expenditure, long project cycles, strict safety regulations, and global supply chain dependencies. Within this challenging environment, digital transformation offers the promise of greater operational efficiency, cost savings, data transparency, and improved project outcomes.

Digital transformation refers to the integration of digital technologies into every area of an organization, fundamentally changing how value is delivered. It involves not just technological tools, but also cultural and organizational change. In project-based industries like oil and gas, digital transformation encompasses a wide range of solutions—ranging from real-time data analytics, AI-driven decision-making tools, digital twins, robotics, predictive maintenance, Internet of Things (IoT), automation of drilling and production operations, and the implementation of integrated project management platforms.

In the oil and gas sector, projects are large in scope, often multinational, and executed under high-risk conditions. The failure of a single project can result in massive financial losses, environmental damage, and reputational harm. As such, **project performance** is a critical factor, typically measured by whether the project is delivered on time, within budget, and according to scope and quality specifications. The industry has historically faced challenges related to delays, cost overruns, health and safety incidents, and misalignment between field teams and decision-makers. The integration of digital technologies offers potential solutions to these persistent problems.

For example, **real-time monitoring systems** can allow project managers to track equipment status and workforce activity from remote locations, enabling immediate action when anomalies are detected. **AI-powered analytics** can support predictive decision-making by identifying risks before they escalate into costly issues. **Cloud-based collaboration platforms** can improve communication and coordination across geographically dispersed teams. In upstream operations, **automation of drilling** can reduce human error and increase precision, while **digital twins**—virtual replicas of physical assets—can simulate performance scenarios to guide planning and design decisions.

Despite these technological advances, many oil and gas projects continue to underperform. Global surveys conducted by McKinsey and the Project Management Institute (PMI) indicate that a significant percentage of capital projects in the oil and gas industry exceed their original timelines and budgets. A key reason for this is that **digital transformation efforts often fall short of expectations** due to poor implementation strategies, lack of alignment with business goals, inadequate training, and resistance to change. This raises important questions about the effectiveness of digital transformation in real-world project performance.

In the context of Saudi Arabia, digital transformation has become a national priority under **Vision 2030**, which aims to diversify the economy and drive technological innovation across all sectors, including oil and gas. Leading companies such as **Saudi Aramco**, **SABIC**, and **Saudi Chevron** are investing heavily in digital innovation. Projects now include the use of **smart drilling rigs**, **AI-enabled predictive maintenance**, and **cloud-based operations centers**. These technologies are expected to optimize exploration, production, and supply chain activities, while also improving project monitoring and execution.

However, while many digital initiatives are being launched, the ability to **quantify their impact on project performance** remains limited. Most oil and gas firms report mixed results, with some projects showing clear benefits while others experience setbacks or minimal return on investment. This inconsistency points to a research gap: **how and to what extent does digital transformation actually influence project performance metrics such as time, cost, and quality?**

The challenge lies not only in adopting new technologies but also in integrating them into the fabric of project management practices. For digital transformation to be effective, it must align with the organizational culture, be supported by leadership, and be guided by clear strategies for training, change management, and system integration. Furthermore, companies need to establish measurable KPIs to evaluate whether their digital investments are improving project outcomes or simply adding layers of complexity.

This research aims to examine the **relationship between digital transformation and project performance in the oil and gas sector**, focusing on upstream and midstream projects within Saudi Arabia. The study will investigate how digital tools are being used, which ones have the most impact, and what challenges are faced in their implementation. It will specifically look at how digitalization affects **time efficiency, cost management, and quality assurance**—the three pillars of project performance.

By addressing these issues, the study hopes to contribute to both academic knowledge and industry practice. From a theoretical perspective, it fills a gap in literature by providing empirical data on a sector that is often underrepresented in digital transformation research. From a practical standpoint, it will offer project managers, engineers, and organizational leaders insights into which technologies drive the most value, how to implement them effectively, and how to overcome barriers that hinder digital maturity.

In summary, the oil and gas sector is undergoing a critical transition toward digitalization, driven by market pressures, regulatory demands, and strategic vision. While the potential benefits are immense, the pathway to success is not guaranteed. There is a clear need for rigorous research that not only explores the impact of digital tools but also offers a roadmap for effective integration into project management frameworks. This research seeks to answer that call.

1.2. Research Problem

Despite the evident shift toward digitalization, oil and gas companies continue to face significant challenges in project execution. Many digital initiatives fail to produce measurable outcomes, either due to lack of integration, poor change management, or misalignment with project objectives. In several cases, investments in digital systems do not translate into improved project KPIs such as reduced delays, cost savings, or better risk control.

1.2.1. Theoretical Gaps

Although literature exists on digital transformation in general industries, **research specific to its impact on project performance within oil and gas remains limited.** Most studies are conceptual or case-specific, with limited empirical data linking digital adoption to key project success metrics.

1.2.2. Practical Gaps

Many oil and gas firms struggle to fully implement digital transformation strategies, either due to resistance to change, lack of skilled personnel, or absence of standardized frameworks. As a result, **project managers lack clear guidance** on how to apply digital tools effectively to improve performance.

Main Research Problem:

What is the impact of digital transformation on project performance in the oil and gas sector, particularly in terms of time, cost, and quality outcomes?

1.3. Research Significance

1.3.1. At the theoretical level

This study contributes to the growing body of knowledge by **bridging the gap between digital innovation theory and project management performance** within a high-risk,

capital-intensive industry. It provides a structured model for understanding how technology adoption aligns with project success.

1.3.2. At the practical level

The findings will provide **project managers, engineers, and strategic leaders** in oil and gas companies with practical insights into the real impact of digital tools. This can inform better decisions regarding investment, training, and integration of digital solutions.

1.4. Research Questions

- How does digital transformation influence project delivery time in the oil and gas sector?
- What is the relationship between digital technologies and cost performance in projects?
- To what extent does digital transformation improve quality and operational safety?
- What are the barriers that limit the effective implementation of digital tools?

1.5. Research Objectives

- To evaluate the influence of digital transformation on project timelines
- To assess the impact of digital adoption on project cost control
- To measure the relationship between digitalization and quality/safety in projects
- To identify the main challenges in applying digital tools in oil and gas projects

1.6. Research Hypotheses

- **H1:** Digital transformation has a significant positive effect on project delivery time.
- **H2:** Digital transformation significantly reduces project cost overruns.
- **H3:** Digital transformation improves the quality and safety of oil and gas projects.
- **H4:** Organizational and technological barriers negatively affect the success of digital transformation.

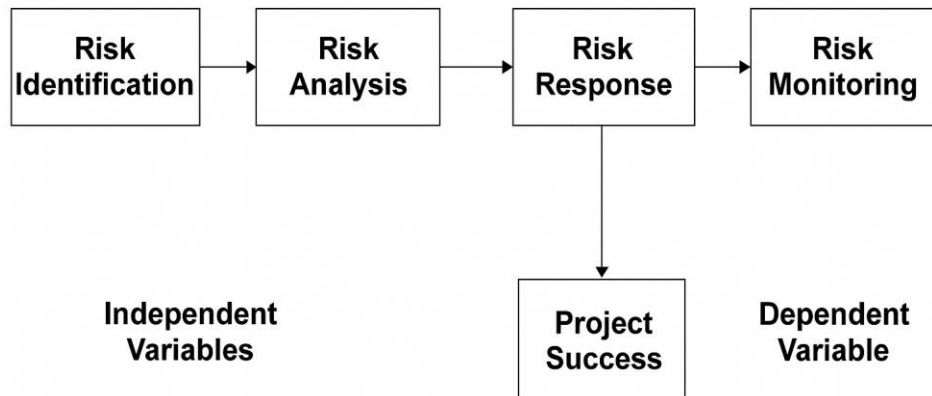
1.7. Research Model

The independent variables will be:

- Digital Infrastructure
- Automation & AI tools
- Data Integration & Real-time Monitoring
- Change Management Practices

Dependent Variable:

- **Project Performance** (time, cost, quality)



1.8. Scope of The Study

- **Geographical Scope:** Saudi Arabia
- **Industry Scope:** Upstream and midstream oil and gas projects
- **Time Scope:** Projects executed or digitalized between 2019–2024
- **Respondents:** Project managers, engineers, and IT professionals in oil and gas firms

1.9. The Project Structure

This project is organized into five chapters:

1. **Chapter One: Introduction** – Outlines the background, problem, objectives, and scope

2. **Chapter Two: Literature Review** – Reviews past studies on digital transformation and project KPIs
3. **Chapter Three: Methodology** – Describes the research design, sample, and data collection
4. **Chapter Four: Analysis & Findings** – Presents statistical results and discussion
5. **Chapter Five: Conclusions & Recommendations** – Summarizes findings, offers practical suggestions

2.Chapter 2: Literature Review

2.1. Introduction

This chapter reviews relevant academic and industry literature that provides a theoretical foundation for understanding how digital transformation influences project performance in the oil and gas sector. It explores prior studies, key digital technologies, project performance frameworks, and the relationship between technological integration and project outcomes. The purpose is to identify theoretical and practical gaps that justify the present research.

2.2. The independent variable

Digital Transformation

Digital transformation refers to the integration of advanced digital technologies to enhance operational efficiency, decision-making, and innovation. In the oil and gas sector, it involves technologies such as:

- **Artificial Intelligence (AI) and Machine Learning (ML)** for predictive maintenance and drilling optimization.
- **Big Data Analytics** for real-time decision-making and reservoir modeling.
- **Internet of Things (IoT)** for remote monitoring of equipment and production systems.
- **Cloud Computing and Digital Twins** for simulation, data integration, and collaboration across geographies.

According to *Vial (2019)*, digital transformation is not just about technology adoption—it represents a fundamental change in organizational culture, processes, and strategy. In the oil and gas industry, *Accenture (2021)* notes that digitalization improves safety, reduces downtime, and enhances productivity by connecting subsurface, drilling, and surface data in one digital ecosystem.

The transformation process typically involves three dimensions:

1. **Technological** – implementation of automation, IoT, and analytics.
2. **Organizational** – changes in culture, structure, and workflows.
3. **Strategic** – alignment of digital initiatives with business goals and sustainability targets.

2.3. The dependent variable

Project Performance

Project performance measures how effectively a project achieves its objectives in terms of **time, cost, quality, and safety**. In the oil and gas industry, project success is influenced by factors such as schedule adherence, risk management, stakeholder satisfaction, and environmental compliance (*Pinto & Slevin, 2016*).

Key performance indicators (KPIs) include:

- **Cost efficiency** – maintaining budgets and minimizing overruns.
- **Schedule performance** – meeting deadlines through digital project tracking.
- **Quality of deliverables** – ensuring technical and operational excellence.
- **HSE performance** – applying predictive analytics for safer operations.

Modern frameworks (such as PMI's PMBOK and ISO 21500) emphasize integrating technology-driven performance monitoring tools to improve decision-making.

2.4. The relationship between the independent and the dependent variables

Numerous studies confirm a positive relationship between digital transformation and project performance. *Lee et al. (2020)* found that digital integration leads to improved project planning accuracy, reduced non-productive time, and enhanced coordination among teams. In oil and gas, *Deloitte (2022)* reported that digitalization could reduce project execution time by up to 20% through real-time collaboration and automation.

Mechanisms of impact:

- **Data-driven decision-making:** Improved forecasting and reduced uncertainty.

- **Automation:** Reduces manual errors and enhances efficiency in repetitive tasks.
- **Collaboration platforms:** Facilitate multi-disciplinary communication across project phases.
- **Predictive analytics:** Anticipates risks and maintenance needs, minimizing downtime.

However, barriers such as high initial investment, data integration challenges, and resistance to change can limit digital transformation success (PwC, 2021).

2.5. Conclusion

The literature suggests that digital transformation acts as a catalyst for improving project performance in oil and gas operations. By adopting digital technologies and fostering a culture of innovation, companies can achieve operational excellence and sustainability. However, further empirical research is needed to quantify these impacts and understand how organizational readiness and leadership support influence digital project success.

References (Sample – APA 7th Edition)

- Accenture. (2021). *Digital transformation in the oil and gas industry*. Accenture Energy Insights.
- Deloitte. (2022). *The digital imperative in oil and gas: Driving operational excellence through technology*.
- Pinto, J. K., & Slevin, D. P. (2016). *Critical success factors in effective project implementation*. IEEE Transactions on Engineering Management.
- PwC. (2021). *Digitization and the future of energy projects*.
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, 28(2), 118–144.

- Lee, J., Bagheri, B., & Kao, H.-A. (2020). *Industrial Big Data Analytics and Smart Manufacturing*. Elsevier.

Appendix A – Questionnaire

Section A: Demographic Information

Please select the option that best describes you.

#	Question	Options
1	Gender	☐ Male ☐ Female
2	Age	☐ 20–29 ☐ 30–39 ☐ 40–49 ☐ 50+
3	Position	☐ Engineer ☐ Supervisor ☐ Manager ☐ Other
4	Years of experience in the oil & gas industry	☐ 1–5 ☐ 6–10 ☐ 11–15 ☐ 16+
5	Company type	☐ Operator (e.g., Aramco) ☐ Contractor (e.g., Halliburton) ☐ Service Company ☐ Other

Section B: Digital Transformation (Independent Variable)

Please indicate your level of agreement with the following statements.

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

#	Statement	Scale (1–5)
DT1	My organization actively adopts digital technologies to improve operations.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
DT2	The company uses real-time data analytics to support decision-making.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
DT3	Automation and IoT systems are integrated into project execution.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
DT4	Employees receive sufficient training on new digital tools.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
DT5	Digital transformation is aligned with the company's strategic objectives.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
DT6	The use of digital platforms enhances collaboration and communication.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Section C: Project Performance (Dependent Variable)

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

#	Statement	Scale (1–5)
PP1	Project tasks are completed within the planned time schedule.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

PP2	Project costs are effectively controlled through digital tracking systems.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
PP3	The quality of project deliverables meets the required standards.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
PP4	Safety performance has improved due to data-driven monitoring.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
PP5	Communication and coordination among teams are efficient.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
PP6	Overall, project performance has improved with digital adoption.	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Appendix B – Table of Research Instruments

Variable	Dimension / Indicator	Sample Questionnaire Items	Measurement Scale	Source
Digital Transformation (IV)	Technological Adoption	DT1, DT2, DT3	5-point Likert	Adapted from Vial (2019); Deloitte (2022)
	Organizational Readiness	DT4, DT5	5-point Likert	Adapted from Accenture (2021)
	Collaboration & Data Integration	DT6	5-point Likert	Researcher-developed
Project Performance (DV)	Time & Cost Efficiency	PP1, PP2	5-point Likert	Pinto & Slevin (2016)
	Quality & Safety	PP3, PP4	5-point Likert	Researcher-developed
	Team Communication & Overall Success	PP5, PP6	5-point Likert	Lee et al. (2020)

3. Chapter 3: Research Methodology

3.1. Introduction

This chapter describes the research methodology used to examine *the impact of digital transformation on project performance in the oil and gas sector*. It outlines the research design, operational definitions, population, sampling techniques, data collection methods, and statistical analysis. A mixed-method approach was adopted to combine the strengths of both quantitative and qualitative methods,

ensuring a comprehensive understanding of how digital initiatives influence project success.

3.2. Operational definitions for research variables

Variable	Definition	Key Dimensions	Measurement Tools
Digital Transformation (Independent Variable)	The strategic integration of advanced digital technologies—such as IoT, Big Data, AI, and automation—to improve efficiency, safety, and collaboration within oil and gas projects.	Technological adoption, organizational readiness, collaboration and integration	6 items (Likert scale) from the questionnaire
Project Performance (Dependent Variable)	The level to which a project achieves its planned objectives in terms of time, cost, quality, and safety outcomes.	Time and cost efficiency, quality and safety, team communication, overall project success	6 items (Likert scale) from the questionnaire

3.3. Research design (research onion)

The research design follows the “**Research Onion**” model developed by Saunders et al. (2019).

1. Research Philosophy – Pragmatism:

Pragmatism allows the researcher to combine both quantitative and

qualitative insights, focusing on real-world problem-solving within industrial settings.

2. Research Approach – Deductive and Inductive:

The quantitative part uses a **deductive approach** to test the hypothesis that digital transformation positively affects project performance.

The qualitative part uses an **inductive approach** through interviews to explore themes emerging from participants' experiences.

3. Research Strategy – Survey and Interview:

A structured questionnaire was used for quantitative data collection, and semi-structured interviews were conducted with project managers and engineers for qualitative insights.

4. Time Horizon – Cross-sectional:

Data was collected once from different oil and gas professionals rather than over time, making the study cross-sectional.

5. Data Collection – Mixed Method:

- a. Quantitative data: collected via an online survey distributed to field engineers, supervisors, and managers.
- b. Qualitative data: collected through interviews to gain in-depth understanding of digitalization challenges and benefits.

3.4. Research population & Sampling methods and technique

The **population** includes professionals working in the oil and gas industry, specifically within drilling, production, and project management departments in Saudi Arabia.

Sampling Technique:

A **purposive sampling method** was applied to target participants who have direct involvement with digital tools or project execution activities.

Sample Size:

- **Quantitative:** 60–100 respondents from operators, service providers, and contractors (e.g., Aramco, Halliburton, Schlumberger).
- **Qualitative:** 5–8 participants selected for interviews to provide detailed perspectives.

3.5. Data collection method

Data was collected using both **primary** and **secondary sources**:

- **Primary Data:**
 - Questionnaire (Appendix A) designed using a 5-point Likert scale.
 - Semi-structured interviews conducted via online meetings or on-site discussions.
- **Secondary Data:**

Academic journals, industry reports (e.g., Deloitte, Accenture, PwC), and prior research studies were reviewed to support the theoretical framework.

All data were gathered confidentially, with participants informed of their rights and the study's purpose.

3.6. Types of data

Two types of data were collected:

- **Quantitative Data:** Numeric data obtained from survey responses, analyzed using statistical tools.
- **Qualitative Data:** Narrative data from interview transcripts, analyzed through coding and thematic analysis.

This combination enhances the validity of findings and provides both breadth (quantitative) and depth (qualitative) understanding.

3.7. Statistical analysis procedures

The quantitative data will be analyzed using **SPSS** software, employing the following techniques:

- **Descriptive Statistics** – to summarize demographic data.
- **Reliability Analysis (Cronbach's Alpha)** – to test internal consistency of the questionnaire.
- **Correlation Analysis** – to measure the relationship between digital transformation and project performance.
- **Regression Analysis** – to determine the predictive effect of digital transformation on project performance.

The qualitative data will undergo **thematic analysis**, identifying recurring patterns and insights related to digitalization impacts and challenges.

3.8. Conclusion

This chapter outlined the methodological foundation of the study. A mixed-method approach was selected to provide a holistic understanding of how digital transformation affects project performance in oil and gas operations. By combining survey data with interview insights, the research ensures robust, reliable, and contextually grounded findings.

4. Chapter 4: Statistical Analysis & Findings discussion

4.1. Introduction

4.2. Sample profile (descriptive statistics for research sample)

4.3. Validity & reliability tests for the questionnaires

4.4. Descriptive statistics for research variables (answer research questions)

4.5. Testing Hypotheses & Findings Discussion

4.6. Conclusion

5. Chapter five: Research limitations, Recommendations & Conclusion

5.1. Research Limitations & Future Research

5.2. Research Recommendations

5.3. Conclusion

References

Appendix

