



Digital Transformation in Capital Construction Projects

A Case Study in the Digital Transformation of Saudi Arabia,
Eastern Region

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التحول الرقمي في إدارة مشاريع البناء الحديثة

دراسة حالة التحول الرقمي في المملكة العربية السعودية المنطقة الشرقية

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Abstract

The study targeted the role of the mediator for digital transformation in construction projects affiliated with Saudi Aramco.

This is followed by a questionnaire survey with wider practitioners from the public and private sectors to validate the findings and rank the hypothesis to enable the implementation

The study relied on the descriptive analytical approach and quantitative study. The study population was 73,000 and the study sample was 382.

The electronic questionnaire was distributed and 30 valid questionnaires were taken for analysis, representing the study community.

The data were analyzed using statistical analysis software.

Accordingly, this study explores stakeholder dynamics for adopting digital technologies in the construction sector, especially those affecting construction project management.

Managing the information is crucial to the success of a construction project. This process is, however, often challenging because requirements are typically voluminous and written in an unstructured paper-based format.

The proposed system is expected to help the project planner quickly develop an electronic database of contractual work requirements, enabling significantly improved efficiency in project planning and verification.

Table of constants:

1 Research Background

- 1.1 Acknowledgement
- 1.2 Dedication
- 1.3 Introduction.

2 Research Problem

- 2.1 Research significant
- 2.2 Theoretical Significant
- 2.3 Empirical Significance

3 Research Questions

- 3.1 Research Objectives

4 Mediating Variables

- 4.1 Research Model
- 4.2 Scope of study
- 4.3 Project structure

5 Literature Review.

- 5.1 Introduction
- 5.2 Research Variable (Digital Transformation)
- 5.3. Benefits of Digital Transformation in Construction
- 5.3 Challenges of Digital Transformation in Construction
- 5.4 Research Variable (Capital Construction projects)
- 5.5. Future Trends in Capital Construction Projects
- 5.6. Relationship between Digital Transformation and Capital Construction Projects.
 - Challenges in the Relationship.
- 5.8. Conclusion

6 Findings

7 Referencing

1. Research Background:

1.1• Acknowledgement:

I Would Like to express my Heartfelt Gratitude to my Family for their Unwavering Support, Love and Encouragement Throughout this Project. Their Understanding, Patience, and Belief in me have been the Cornerstone of my Success.

Thank you for Being my Constant Source of Inspiration and Motivation.

I also Want to Thanks my Advisor, **Mr. Nasser Al-Muhaimid**, for Providing this Opportunity to Complete my University Studies.

1.2• Dedication:

I Dedicate This Project to my Wife, Whose Support, and Encouragement have been my Guiding Light. Your Belief in me and your Sacrifices have made this Journey Possible. Thank you for Being my Confidant, and my Source of Strength.

1.3• Introduction:

The history of project management presents ample examples of technological needs-driven management innovations on projects (Sankaran et al., 2021). Industry 4.0 is now well understood as a fundamental anchor for digital transformation. Industry 4.0, while radically addressing many challenges of the conventional delivery models and bringing manifold benefits in terms of productivity, cost, quality, time, resource efficiency, collaboration and communication, safety, and sustainability (Craveiro et al., 2019; Oesterreich and Teuteberg, 2016), has brought about a certain degree of ambiguity and lack of clarity, especially in its adoption and adaptation (Karmakar and Delhi, 2021; Muñoz-La Rivera et al., 2021; Winfield, 2020), even to an extent to say that we are not in a position to even understand the readiness of construction sector for industry 4.0 (Maskuriy et al., 2019). For instance, industry 4.0 in the construction sector has caused productivity gains when lean construction concepts based on integrated project delivery methods are coupled with building information modelling (BIM) based digital twin technologies. Nevertheless, the data transfer's reliability and interoperability impede and challenge the wider application. Digital transformation has become a cornerstone in the evolution of capital projects, reshaping the way infrastructure is developed, constructed, and managed. In an era defined by rapid technological advancement, the integration of digital tools and methodologies has emerged as a key strategy for driving efficiency, collaboration, and innovation in the capital project landscape. Capital projects encompass a wide range of endeavors, from building bridges and highways to constructing energy facilities and urban developments. Traditionally, these projects have been characterized by complex workflows, disparate stakeholders, and inherent risks. However, the advent of digital transformation has ushered in a new era of

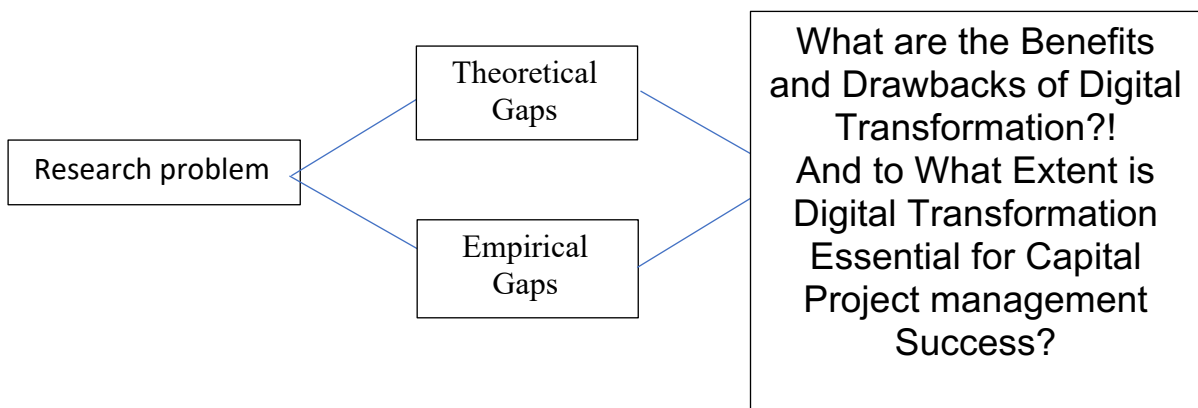
possibility, enabling stakeholders to overcome traditional challenges and unlock new opportunities for success. At the heart of digital transformation in capital projects lies the convergence of various technologies, including Building Information Modeling (BIM), Internet of Things (IoT), Artificial Intelligence (AI), and Augmented Reality (AR). These technologies, when integrated effectively, empower project teams to streamline processes, enhance decision-making, and optimize project outcomes. This introduction explores the profound impact of digital transformation on capital projects, examining key trends, challenges, and opportunities shaping the industry. From improving collaboration and productivity to mitigating risks and enhancing sustainability, digital transformation promises to revolutionize the way capital projects are conceived, executed, and delivered in the 21st century. Digital transformation and adoption hinge on several dimensions spanning organisational and stakeholder spaces. This is critical since research revealed that local stakeholders had varying views about localised digital solutions in projects (Wang and Lu, 2021). According to Alaimo & Kallinikos (2021), organisations can no longer be framed as separate from the technologies they deploy. Thus, there is a need to understand the dynamics of digital transformation with the organisational processes and project participants, especially in the construction industry. It is crucial to understand whether digital technologies impact project management approaches (will) and how they would impact (how). Thus, it became imperative to inquire about the 'will' and 'how' of the construction sector's journey on the industry 4.0 path.

In this study, the objective is to understand the dynamics of the project participants in enabling the adoption of industry 4.0 in the construction sector in a holistic approach. As indicated earlier, the study looks at the 'will' and 'how' to understand the stated dynamics.

2• Research Problem:

Identifying research problems in digital transformation, particularly in the context of capital construction projects, can help guide future studies and improve both theoretical understanding and practical applications.

How can different digital technologies be effectively integrated to work seamlessly together in construction projects?



2.1• Research significant:

2.2-Theoretical Significant:

Digital transformation in capital construction projects holds significant theoretical implications across various domains. Digital tools can enhance the sustainability of construction projects by optimizing resource use, reducing waste, and improving energy efficiency. Theoretical models of lifecycle analysis can be enhanced with digital data, providing more accurate assessments of a project's environmental footprint over its entire lifecycle. By integrating these perspectives, the theoretical significance of digital transformation in capital construction projects can be comprehensively understood, offering valuable insights for both academic research and practical application.

2.3-Empirical Significance:

The empirical significance of digital transformation in capital construction projects is well-documented, showcasing improvements in efficiency, cost management, risk mitigation, quality, sustainability, and stakeholder satisfaction. These benefits underscore the importance of continued investment and research in digital technologies within the construction industry. Digital transformation is crucial because it enables organizations to adapt to the rapidly changing technological landscape, improve efficiency, enhance customer experiences, stay competitive, and innovate. By leveraging digital technologies, businesses can streamline operations, gain insights from data analytics, reach new markets, and create new revenue streams. Additionally, digital transformation fosters agility and resilience, allowing organizations to better respond to market shifts and customer demands.

3. Research Questions:

Research sub-question are specific questions that are derived from the main research question.

- What are the best practices for integrating digital transformation into traditional project management methodologies in capital construction?
- How dose digital transformation impact the overall quality and durability of constructed assets in capital projects?
- What are the most effective digital tools and technologies for enhancing efficiency in capital construction projects?

- What are the barriers and challenges to implementing digital transformation in capital construction project?

The researcher is conducting a study entitled “Digital Transformation in Capital Construction Projects: A Field Study in Engineering Consulting Companies in the Kingdom of Saudi Arabia,” which is part of the requirements for obtaining a Bachelor’s degree in Business Administration from Midocean University.

Therefore, the success of this study depends on the extent of your contribution in reading it carefully and then Answer its paragraphs by placing a mark (X) in the box that agrees with your opinion.

I thank you for your cooperation in reaching the results of this study.

I would like to inform you that the information contained in the questionnaire will be used exclusively for scientific research purposes and will be treated with complete confidentiality.

With high respect and appreciation.

Supervisor.

Dr. Mona Moustafa Elashry

Researcher's name.

Ali Almuslem

DATE

JUN.25.2024

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3.1. Research Objectives:

Assess the current state and environmental sustainability benefits of digital adoption within capital construction projects.

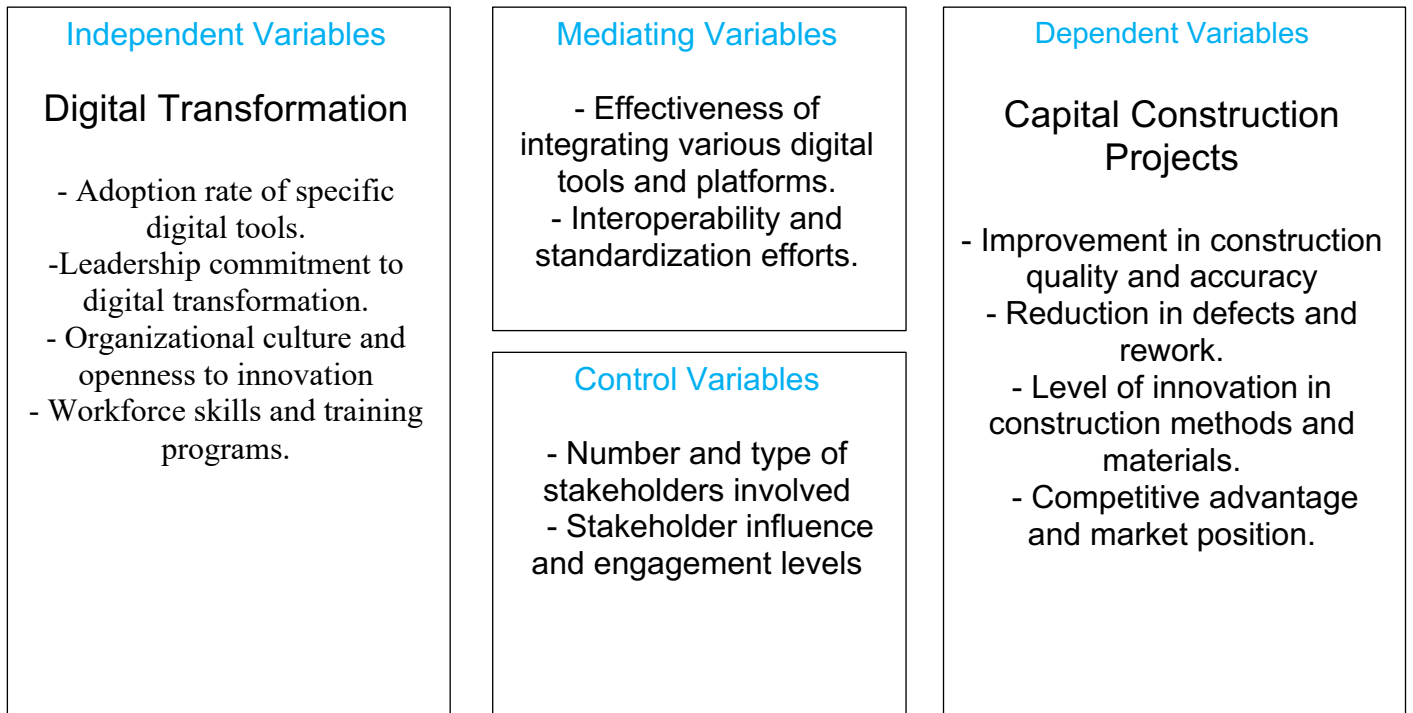
Develop recommendation and best practices for integrating digital transformation into existing project management frameworks in capital construction.

Evaluate the effectiveness of various digital tools and technologies in streamlining project management processes.

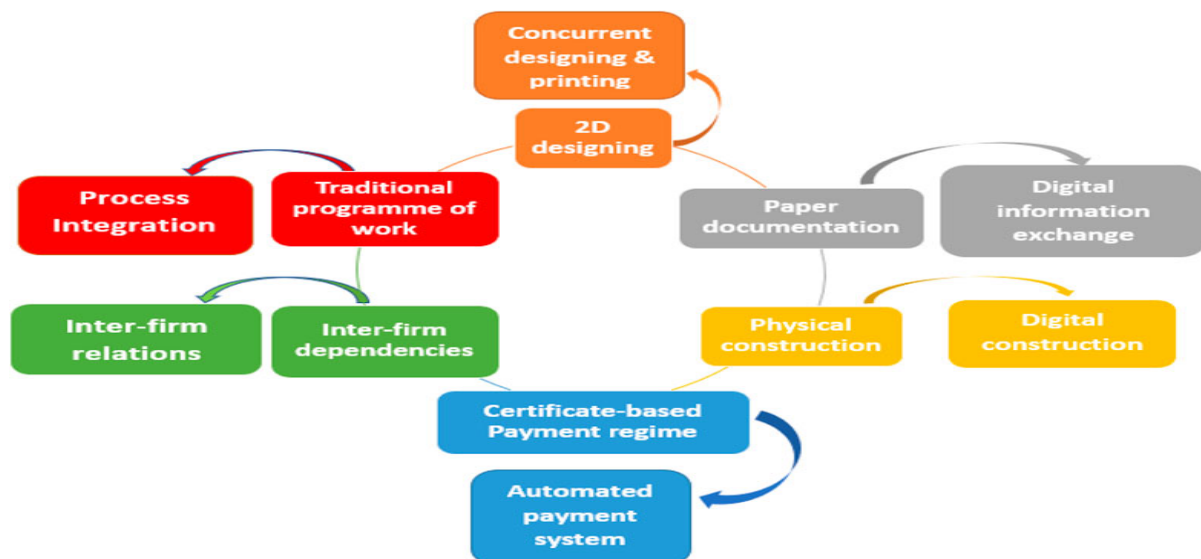
Analyze the barriers and challenges hindering the successful implementation of digital transformation in capital construction projects.

- Digital transformation in capital construction project leads to increased productivity and efficiency in the construction process.
- Digital transformation improves the accuracy and efficiency of project management.

4. Mediating Variables:



4.1. Research Model:



4.2. Scope of study:

Kingdome of Saudi Arabia – Capital Construction Projects (Roads, Bridges).

4.3. Project structure:

- - Introduction.
- - Literature Review.
- - Statistical Analysis.
- - Finding 'Discussion and Conclusion.

5. Literature Review:

5.1- Introduction

Digital transformation has become a cornerstone in the evolution of capital projects, reshaping the way infrastructure is developed, constructed, and managed. In an era defined by rapid technological advancement, the integration of digital tools and methodologies has emerged as a key strategy for driving efficiency, collaboration, and innovation in the capital project landscape. Capital projects encompass a wide range of endeavors, from building bridges and highways to constructing energy facilities and urban developments.

5.2 Research Variable (Digital Transformation)

Digital transformation refers to the integration of digital technology into all areas of business, fundamentally changing how organizations operate and deliver value to customers. In the context of capital construction projects, digital transformation involves the adoption of technologies such as Building Information Modeling (BIM), Internet of Things (IoT), artificial intelligence (AI), cloud computing, and blockchain to enhance various aspects of construction processes.

5.3 Benefits of Digital Transformation in Construction

Increased Efficiency and Productivity:

- Digital tools streamline processes, reduce manual tasks, and improve workflow automation.
- Enhanced planning and resource management lead to faster project completion.

Cost Reduction:

- Optimized resource use and reduced waste lower overall project costs.
- Improved accuracy and early detection of issues minimize costly rework.

Enhanced Quality and Safety:

- Digital monitoring and analytics improve quality control and safety standards.
- Real-time data and predictive maintenance reduce the likelihood of accidents and defects.

Better Collaboration and Communication:

- Digital platforms facilitate seamless communication among stakeholders.
- Collaborative tools enhance coordination and reduce misunderstandings.

Sustainability and Environmental Impact:

- Digital tools help optimize energy use and minimize environmental impact.
- Improved planning and monitoring support sustainable construction practices.

5.4 Challenges of Digital Transformation in Construction

Resistance to Change:

- Organizations may face resistance from employees accustomed to traditional methods.
- Effective change management and training programs are essential.

High Initial Investment:

- Implementing digital technologies can require substantial initial investment.
- Long-term benefits need to be clearly communicated to justify costs.

Data Security and Privacy:

- Increased reliance on digital tools raises concerns about data security and privacy.
- Robust cybersecurity measures and policies are necessary.

Interoperability Issues:

- Different digital tools and platforms need to work seamlessly together.
- Standardization and integration efforts are critical for successful implementation.

Skill Gaps:

- The workforce may lack the necessary skills to effectively use new technologies.
- Continuous training and upskilling programs are required.

5.5 Research Variable (Capital Construction projects)

Capital construction projects are crucial for economic development and societal advancement. By embracing digital transformation and innovative practices, the construction industry can overcome challenges and deliver projects that are efficient, cost-effective, and sustainable.

Capital construction projects refer to large-scale construction endeavors aimed at creating significant physical infrastructure or facilities that have long-term value and use. These projects are often substantial in scope, cost, and duration, involving a wide array of stakeholders including governments, private enterprises, and the public.

5.6 Future Trends in Capital Construction Projects**Green and Sustainable Construction**

- 5.7 Emphasis on eco-friendly materials, energy-efficient designs, and sustainable construction practices.

Smart Infrastructure

- 5.8 Integration of IoT and smart technologies to create intelligent infrastructure that can monitor and manage itself.

Advanced Construction Technologies

- 5.9 Use of robotics, 3D printing, and modular construction techniques to improve efficiency and reduce labor costs.

Data-Driven Decision Making

- 5.10 Leveraging big data and analytics to inform decision-making and improve project outcomes.

Resilient Design

Designing infrastructure to withstand natural disasters, climate change, and other unforeseen challenges.

5.7 Relationship between Digital Transformation and Capital Construction Projects

The relationship between digital transformation and capital construction projects is multifaceted and deeply impactful. Digital transformation involves integrating advanced digital technologies into various aspects of construction projects, thereby enhancing efficiency, quality, and sustainability.

5.8 Challenges in the Relationship:

- **Resistance to Change**

Organizations may face resistance from employees accustomed to traditional methods. Effective change management and training programs are essential.

- **Interoperability Issues**

Different digital tools and platforms need to work seamlessly together. Standardization and integration efforts are critical for successful implementation.

- **Skill Gaps**

The workforce may lack the necessary skills to effectively use new technologies. Continuous training and upskilling programs are required.

5.9 Conclusion

The relationship between digital transformation and capital construction projects is characterized by significant enhancements in efficiency, quality, and sustainability. By integrating advanced digital technologies into planning, design, execution, and management processes, construction projects can achieve better outcomes, reduce costs, and improve stakeholder satisfaction. Despite challenges, the ongoing evolution of digital tools and practices promises to further transform the construction industry, driving innovation and long-term success.

5.10 Definition of Digital Transformation:

- Digital transformation is the combined effects of several
- digital innovations bringing about novel actors (and actor constellations), structures, practices,
- values, and beliefs that change, threaten, replace, or complement existing rules of the game
- within organizations, ecosystems, industries, or fields.
- Hinings B., Gegenhuber T., Greenwood R. (2018). Digital innovation and transformation: An institutional perspective. *Information and Organization*, 28(1), 52–61.
- Definition of Capital Construction Projects:
- Zhang, Yang;Li, Hui;Yao, Zeliang
Engineering, construction, and architectural management, 12 Dec 2023,

- 6. Findings

The study's results reveal that the performance of construction firms greatly depends on intellectual capital and its components. Furthermore, digital transformation plays a vital moderating role between intellectual capital and its components and construction firm performance.

often measured the effect that specific inputs have on project success. However, the Project management researchers have concept of project success is complicated and there is no consensus as to how it should be measured. The research community and project management practitioners need a simple and direct measurement for project success that is based on objective 5.10.1 measurements and can be used on projects of different types and sizes.

Research Questions:

- 1- What are the best practices for integrating digital transformation into traditional project management methodologies in capital construction?
- 2- How dose digital transformation impact the overall quality and durability of constructed assets in capital projects?
- 3- What are the most effective digital tools and technologies for enhancing efficiency in capital construction projects?
- 4- What are the barriers and challenges to implementing digital transformation in capital construction project?

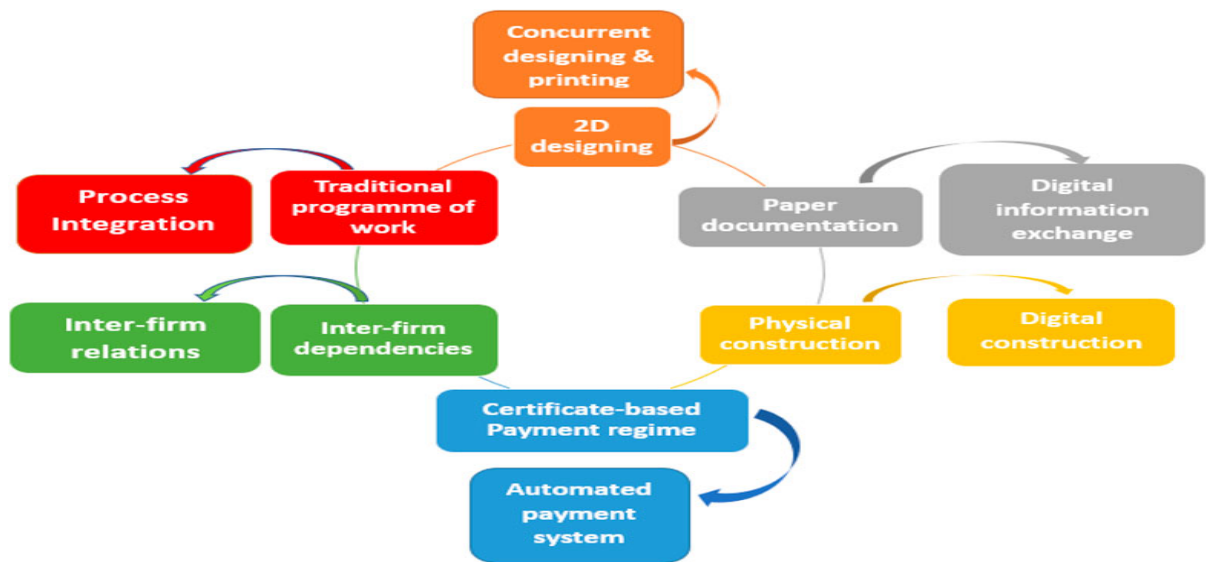
Research Objectives:

- Assess the current state and environmental sustainability benefits of digital adoption within capital construction projects.
- Develop recommendation and best practices for integrating digital transformation into existing project management frameworks in capital construction.
- Evaluate the effectiveness of various digital tools and technologies in streamlining project management processes.
- Analyze the barriers and challenges hindering the successful implementation of digital transformation in capital construction projects.
-

Research Hypotheses:

- Digital transformation in capital construction project leads to increased productivity and efficiency in the construction process.
- Digital transformation improves the accuracy and efficiency of project management.

Research Model:

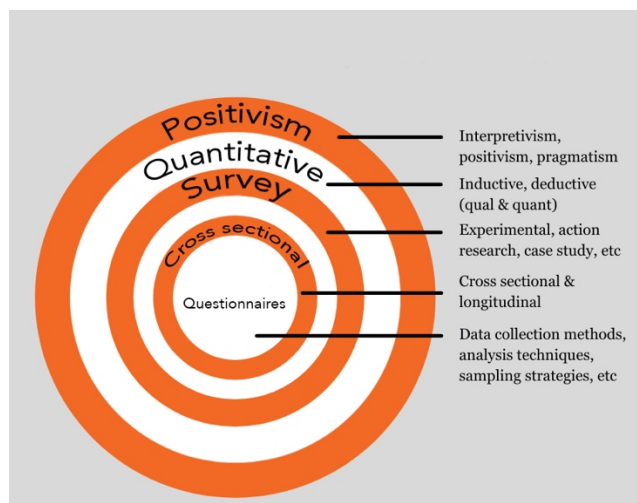


Research Methodology:

Quantitative methods

Process optimization: Improve workflow efficiency and optimize resource utilization throughout the construction process.

Organizational change: Provide training programs to equip employees to effectively utilize new technologies and tools, Secure leadership buy-in and support for digital transformation initiatives, ensuring alignment with strategic goals.



Scope of study:

Kingdome of Saudi Arabia – Capital Construction Projects (Roads, Bridges).

Suggested Project structure:

- Introduction.
- Literature Review.
- Research Methodology.
- Statistical Analysis.
- Finding 'Discussion and Conclusion.

Literature Review:

Digital transformation has become a cornerstone in the evolution of capital projects, reshaping the way infrastructure is developed, constructed, and managed. In an era defined by rapid technological advancement, the integration of digital tools and methodologies has emerged as a key strategy for driving efficiency, collaboration, and innovation in the capital project landscape. Capital projects encompass a wide range of endeavors, from building bridges and highways to constructing energy facilities and urban developments. Traditionally, these projects have been characterized by complex workflows, disparate stakeholders, and inherent risks. However, the advent of digital transformation has ushered in a new era of possibility, enabling stakeholders to overcome traditional challenges and unlock new opportunities for success. At the heart of digital transformation in capital projects lies the convergence of various technologies, including Building Information Modeling (BIM), Internet of Things (IoT), Artificial Intelligence (AI), and Augmented Reality (AR). These technologies, when integrated effectively, empower project teams to streamline processes, enhance decision-making, and optimize project outcomes. This introduction explores the profound impact of digital transformation on capital projects, examining key trends, challenges, and opportunities shaping the industry. From improving collaboration and productivity to mitigating risks and enhancing sustainability, digital transformation promises to revolutionize the way capital projects are conceived, executed, and delivered in the 21st century.

Definition of Digital Transformation: Digital transformation is the combined effects of several digital innovations bringing about novel actors (and actor constellations), structures, practices, values, and beliefs that change, threaten, replace, or complement existing rules of the game within organizations, ecosystems, industries, or fields.

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Definition of Capital Construction Projects: Project management researchers have often measured the effect that specific inputs have on project success. However, the concept of project success is complicated and there is no consensus as to how it should be measured. The research community and project management practitioners need a simple and direct measurement for project success that is based on objective measurements and can be used on projects of different types and sizes.

[Zhang, Yang; Li, Hui; Yao, Zeliang](#)

Engineering, construction, and architectural management, 12 Dec 2023,

- Research Population & Sampling methods & Technique:

This section provides information about the [Digital Transformation in Capital Construction Projects](#).

The population includes all entities and individuals involved in capital construction projects where digital transformation initiatives are being implemented.

- But We will Take [SAUDI ARAMCO](#) as the most important and largest company that relies on Digital Transformation in its project's.

- Research Population ([SAUDI ARAMCO](#))

- As one of the world's largest integrated energy and chemicals companies, Aramco seeks to create value across the hydrocarbon business chain, while driving economic and societal development in communities around the world that depend on our energy supplies.
- We are committed to pioneering the energy transition and embrace our responsibility to help the world achieve a net-zero economy, with our employees constantly working to help find solutions to sustainability challenges.
- As we continue to strengthen our position at the forefront, we will remain the supplier of choice for our customers, and continue to deliver long-term value to our shareholders, with our ambition to supply communities around the world with reliable, more sustainable and affordable energy.
- **SIZE OF STUDY (73,000 +)**

JOB LEVEL	# OF ELEMENTS
TOP MANAGEMENT	20
MIDDLE MGT.	270
LOWER MGT.	4000
SUPERVISORS	8000
EMPLOYEES	60,710
TOTAL	73,000

- **RESEARCH SAMPLE**

According to Table of Krejci & Morgan the Size of Study is **73,000** and the size of sample **382**

JOB LEVEL	# OF ELEMENTS	# OF SAMPLE
TOP MANAGEMENT	20	4
MIDDLE MGT.	270	54
LOWER MGT.	4000	80

SUPERVISORS	8000	116
EMPLOYEES	60,710	128
TOTAL	73,000	382

- **SAMPLING METHOD & TECHNIQUES**

- In this Research we used Probability Sampling Techniques.
- And the method is Stratified random Sampling.

- **DATA COLLECTION METHOD**

- QUESTIONER.

- **TAPES OF DATA**

- Primary Data
Data Collected from Questioner.
- Secondary Data
Data collected from Research (Saudi Aramco Website).

- **DATA ANALYSIS METHODS & PROCEDURES**

After collecting data, it is essential to analyze the information gathered to draw meaningful conclusions. As, the Statistical Package for the Social Sciences (SPSS), specifically version 28, were used to analyze the collected data.

The sample profile test was conducted, via descriptive analysis, to gain insights into the characteristics of the sample population. It helps researchers understand the demographics, preferences, and other relevant information about the individuals involved in the study.

Validity and reliability tests are crucial in ensuring that the data collected is accurate and consistent. Validity tests (Exploratory factor analysis) to determine if the research instruments measure what they are intended to measure, while reliability tests (Cronbach` Alpha test) assess the consistency of results over time.

And we conducted descriptive statistics for the research variables, that provide a summary of the main characteristics of the data collected. It includes measures such as mean, median, mode, standard deviation, and variance, which help in understanding the distribution and patterns within the dataset.

In order to test the research hypotheses, simple and multiple linear regression tests were employed to test research hypotheses and examine the relationships between variables. These tests help researchers determine the extent to which one variable predicts another, providing valuable insights into the research questions at hand.

By utilizing these various statistical analyses within SPSS version 28, researchers can effectively analyze their data and derive meaningful interpretations to advance their research objectives.

- CONCLUSION

- The research was applied to Saudi Aramco through Probability Sampling Techniques and Stratified random sampling Method.
- Size of population is 7,3000 and Size of sample is 382.

Statistical Analysis

- Introduction.
- Characteristics of the study sample.
- Measuring the validity & reliability of the research tool.
- Descriptive analysis of study variables.
- Linear correlation coefficients between variables.
- Study hypothesis validity test results.
- Conclusion.

- Introduction:

This chapter deals with presenting the results of the field study that were statistically analyzed using the SPSS program, version 29. It includes descriptive statistics for the sample under study, testing the validity and reliability of the questionnaires used to collect the required data from the current study sample, testing the research hypotheses, and the suitability of the research model.

- Characteristics of the study sample:

The study sample was distributed according to gender, number of years of experience, educational level, and nature of work.

- Gender includes (Male, Female)
- Number of years of experience (1-5 / 6-10 / 11-15 / 16-20 / 21-25).
- Education level (Undergraduate, Postgraduate, Diploma, Bachelor, Master)
- Nature of work (Front Line management, Middle management, Top management, Other).

THE FOLLOWING TABLE, FIGURES AND PARAGRAPHS EXPLAIN THE CLASSIFICATION OF THE SAMPLE UNDER STUDY AS FOLLOWS:

		Gender			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mali	27	90.0	90.0	90.0
	Femail	3	10.0	10.0	100.0
	Total	30	100.0	100.0	

		Experience Years			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5	8	26.7	26.7	26.7
	6-10	6	20.0	20.0	46.7
	11-15	5	16.7	16.7	63.3
	16-20	6	20.0	20.0	83.3
	21-25	5	16.7	16.7	100.0
	Total	30	100.0	100.0	

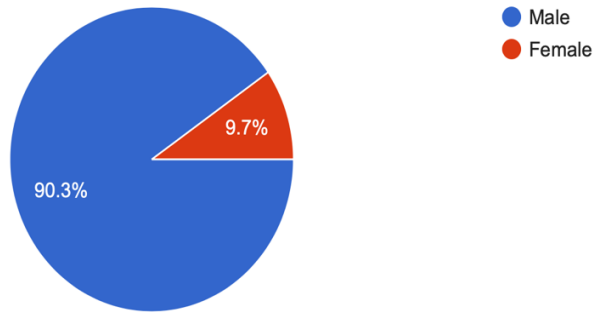
		Degree			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Undergraduate	1	3.3	3.3	3.3
	Postgraduate	15	50.0	50.0	53.3
	Diploma	9	30.0	30.0	83.3
	Bachelor	5	16.7	16.7	100.0
	Master				
	Total	30	100.0	100.0	

		Level of Management			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Front Line management	8	26.7	26.7	26.7
	Middle management	7	23.3	23.3	50.0
	Top Management	2	6.7	6.7	56.7
	Other	13	43.3	43.3	100.0
	Total	30	100.0	100.0	

		Number of Employees			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Small Scale	4	13.3	13.3	13.3
	Medium Scale	7	23.3	23.3	36.7
	large Scale	18	60.0	60.0	96.7
	Other	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

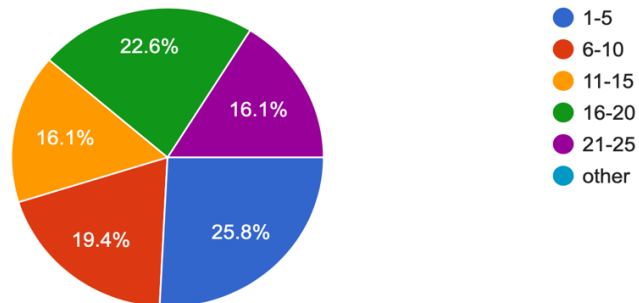
Gender

31 responses



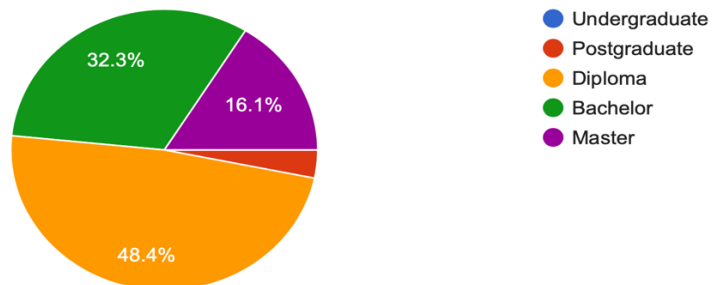
Experience Years

31 responses



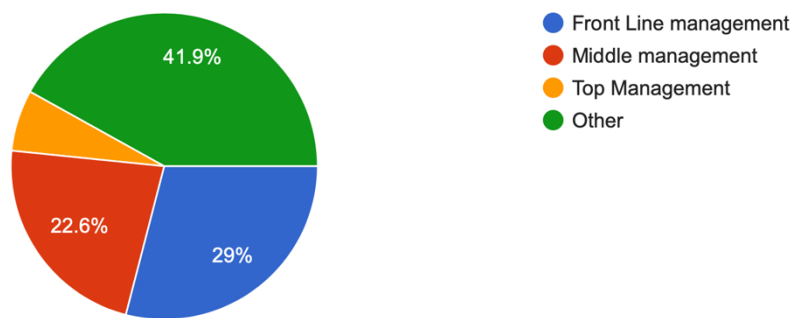
Degree

31 responses



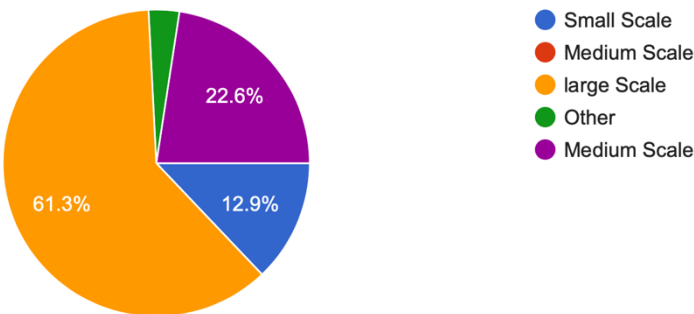
Level of Management

31 responses



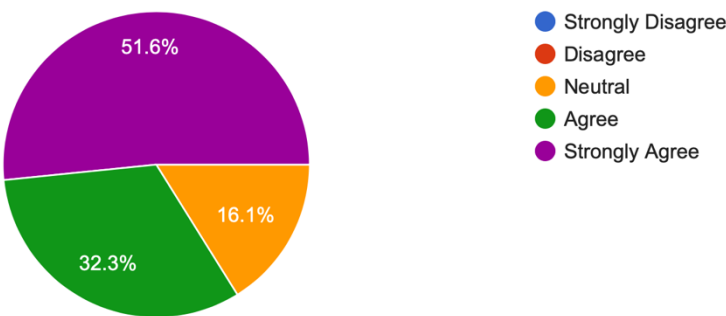
Number of Employees

31 responses



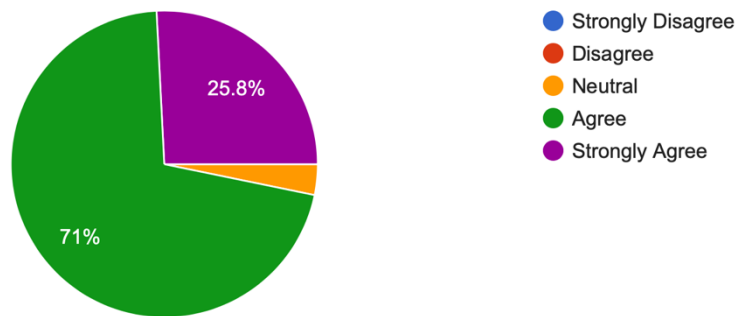
Adoption rate of specific digital tools.

31 responses



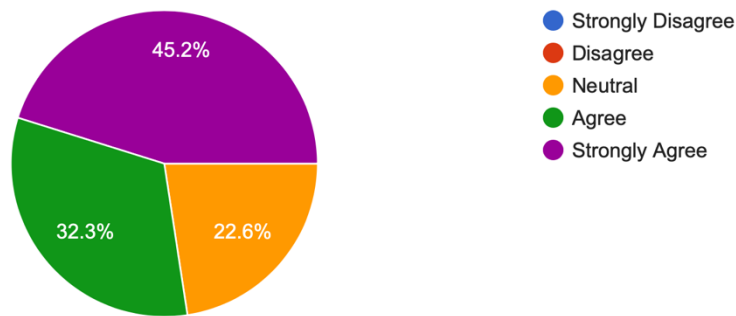
Leadership commitment to digital transformation.

31 responses



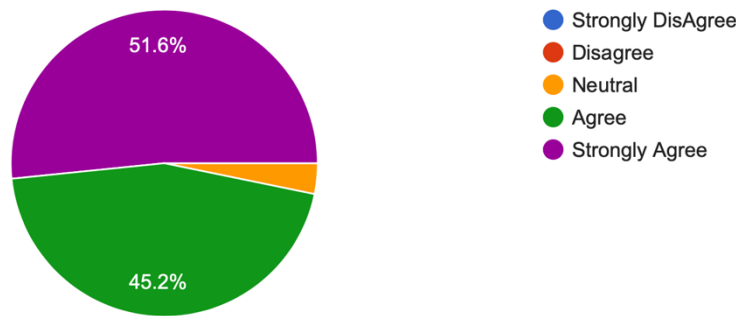
Organizational culture and openness to innovation

31 responses



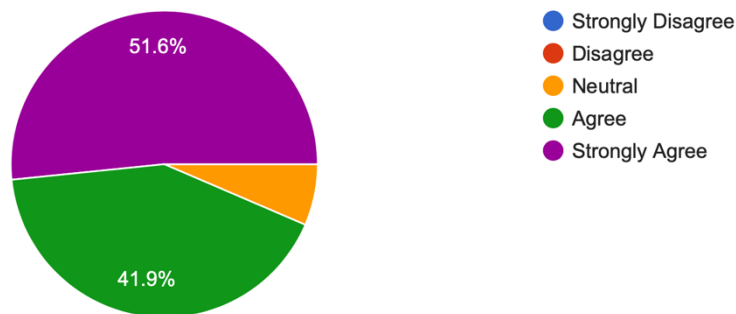
Workforce skills and training programs.

31 responses



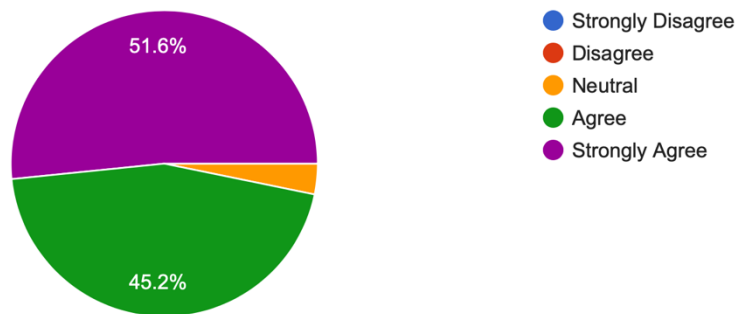
Effectiveness of integrating various digital tools and platforms.

31 responses



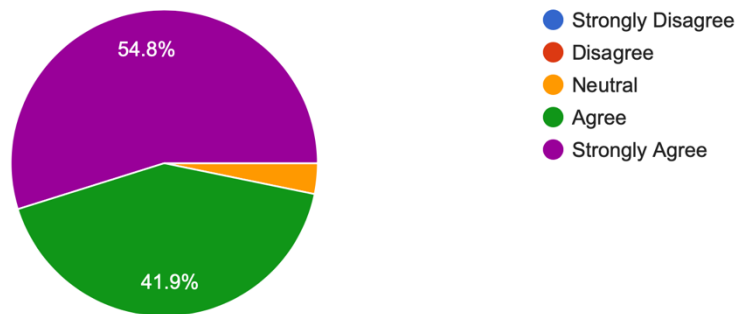
Interoperability and standardization efforts

31 responses



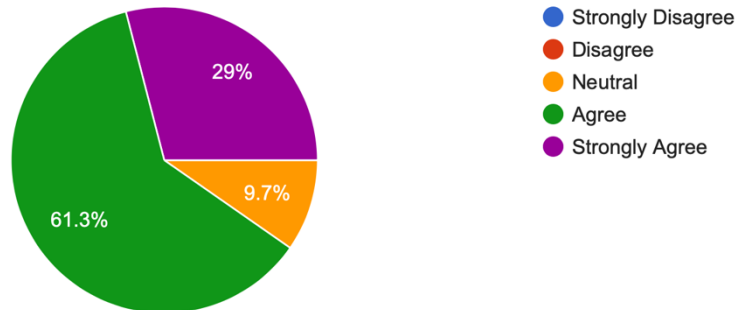
Improvement in construction quality and accuracy

31 responses



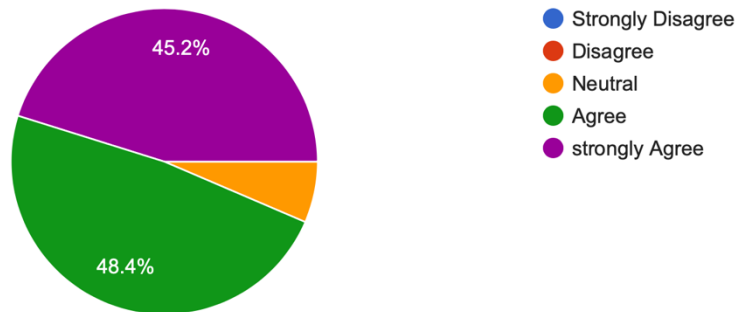
Reduction in defects and rework

31 responses



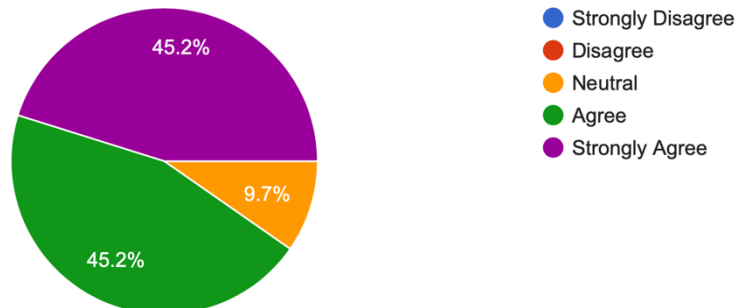
Level of innovation in construction methods and materials.

31 responses



Competitive advantage and market position

31 responses



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.359
Bartlett's Test of Sphericity	Approx. Chi-Square	150.563
	df	105
	Sig.	.002

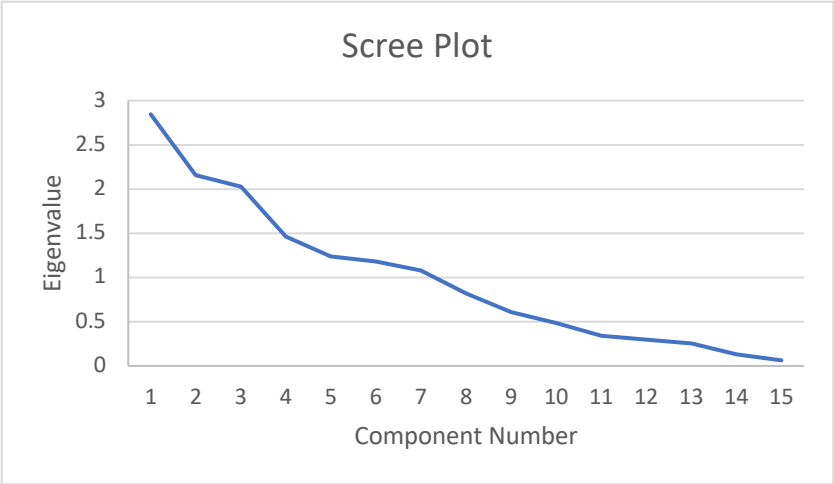
Exploratory factor analysis

	Component						
	1	2	3	4	5	6	7
@4	.857						
@1	-.782						
@4	.779						
@3		.824					
@3		.767					
@4			.815				
@5			.594				
@5				.438			
@1				.915			
@3					.875		
@5					.751		
@5						.813	
@4		.504					
@5						.534	
@4							.949

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 10 iterations.



Item Statistics

	Mean	Std. Deviation	N
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Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.845	18.969	18.969	2.845	18.969	18.969	2.170	14.470	14.470
2	2.160	14.399	33.368	2.160	14.399	33.368	2.007	13.382	27.851
3	2.024	13.496	46.864	2.024	13.496	46.864	1.840	12.268	40.119
4	1.465	9.769	56.633	1.465	9.769	56.633	1.683	11.218	51.337
5	1.241	8.274	64.907	1.241	8.274	64.907	1.520	10.133	61.470
6	1.183	7.886	72.793	1.183	7.886	72.793	1.418	9.451	70.921
7	1.077	7.181	79.974	1.077	7.181	79.974	1.358	9.053	79.974
8	.820	5.465	85.439						
9	.610	4.065	89.504						
10	.486	3.237	92.741						
11	.339	2.263	95.004						
12	.301	2.006	97.010						
13	.255	1.698	98.708						
14	.130	.870	99.578						
15	.063	.422	100.000						

Extraction Method: Principal Component Analysis.

@1	1.10	.305	30
@4	2.80	1.472	30
@4	3.60	.814	30
@1	2.67	1.295	30
@3	2.53	.776	30
@3	4.40	.724	30
@4	4.23	.504	30
@5	4.20	.805	30
@5	4.47	.571	30
@5	4.43	.626	30
@4	4.50	.572	30
@5	4.50	.572	30
@3	4.23	.568	30
@4	4.40	.621	30
@5	4.33	.661	30

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.192	.322	15

Case Processing Summary

		N	%
Cases	Valid	30	100.0
	Excluded ^a	0	.0
	Total	30	100.0

- a. Listwise deletion based on all variables in the procedure.

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
@1	55.30	11.045	.003	.817	.194
@4	53.60	9.559	-.064	.580	.290
@4	52.80	10.166	.061	.839	.178
@1	53.73	11.444	-.226	.734	.374
@3	53.87	10.326	.043	.435	.186
@3	52.00	10.414	.044	.718	.185
@4	52.17	11.247	-.105	.548	.225
@5	52.20	9.821	.134	.504	.145
@5	51.93	11.375	-.144	.418	.242
@5	51.97	10.240	.128	.590	.156
@4	51.90	9.955	.239	.518	.123
@5	51.90	9.955	.239	.522	.123
@3	52.17	9.385	.413	.688	.064
@4	52.00	9.310	.382	.529	.064
@5	52.07	9.789	.222	.531	.119

Ch5: Recommendation, Limitation & Conclusion

5.1 Introduction

The results of the study proved that practicing digital transformation in projects affiliated with Saudi Aramco increased productivity and speed of implementation of tasks by executive management and reduced the risk of project delays.

5.2 Research Limitation

- Spatial Limitation
Search is determined in Saudi Aramco Company in the Kingdom of Saudi Arabia.
- Temporal Limitation
The study extended from the date Jun.08.2024 up to Aug.24.2024.
- Objective Limitation
The role of digital transformation in construction projects.

5.3 Research Recommendation

- Increasing adoption of digital transformation in projects due to its clear impact on increasing productivity and efficiency by departments.
- Improving the quality of work in the company and thus employee satisfaction.
- Developing software to assist in digital transformation to facilitate and accelerate decision-making.

5.4 Future Research

Through what was presented, I tried to address the subject according to the available data and information that could be obtained in order to enable researchers and those interested in this subject to open new

horizons that can address other aspects and focus on points that I did not address in the research.

- Digital Transformation Simulation Construction Projects.
- The impact of digital transformation on the quality of the organization.
- Effective contribution to the development of the work environment.

5.5 Conclusion

The Current Study Aims to Study the Impact of Digital Transformation on Construction Project's.

And the Study was Applied to Saudi Aramco.

The Study Sample Included a Number of the Company's Employees.

The SPSS Statistical Analysis Program was Used to Analyze the Study Results.

• Referencing:

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