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Project Management – Collage of Management

**The Impact of Digital Transformation on Project Management
Performance: A Study of SABIC Company**

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1. Chapter 1: Introduction

1.1 Research Background

Digital transformation has developed from the adoption of isolated information technologies into a broader organizational process in which digital technologies reshape organizational structures, capabilities, decision-making processes, value creation, and relationships with stakeholders. Vial (2019), following a review of 282 studies, conceptualized digital transformation as an organizational response to the disruptions created by digital technologies, requiring organizations to reconsider how they create value while simultaneously managing structural changes and organizational barriers. Consequently, digital transformation should not be understood simply as the purchase of new software or the conversion of manual activities into electronic form; rather, it represents a strategic change in the interaction between technology, people, processes, information, and organizational objectives.

The significance of digital transformation has become particularly evident in project-based environments. Modern projects increasingly depend on integrated information systems, cloud-based collaboration, artificial intelligence, predictive analytics, automated workflows, digital dashboards, and real-time data. A systematic review of 66 peer-reviewed studies on digital transformation in project management found that digital technologies are reshaping project methodologies, governance, leadership, team interaction, decision-making, and the organizational structures through which projects are delivered. The review also concluded that the relationship between digital transformation and project management remains fragmented

and requires more sector-specific empirical investigation, particularly concerning the interaction between technology, organizational arrangements, and human capabilities (Chen et al., 2025).

Digitalization can contribute to project performance by increasing the speed and visibility of information flows, supporting collaboration across geographically dispersed teams, automating repetitive project-control activities, improving risk identification, and allowing managers to make decisions using current rather than delayed information. Research focusing on digital resources in project teams further indicates that digital environments can contribute to project management performance when organizations are capable of converting digitally shared knowledge into integrated organizational capabilities. This suggests that technology by itself does not guarantee improved performance; the organizational ability to use digital information effectively is equally important.

The technological foundation available to project teams is therefore an important component of digital transformation. Khasawneh and Dweiri (2024) examined digital infrastructure for project management success and identified digital readiness, digital fitness, and digital tools as important enabling pillars. Their analysis found digital tools to be especially influential in supporting project management success, while also demonstrating that organizational readiness and capability influence the effectiveness with which technology is applied. A subsequent empirical study by Khasawneh and Dweiri (2025) similarly found significant positive relationships between digital infrastructure dimensions and project management success, reinforcing the argument that successful project digitalization requires a

balanced combination of technological tools, organizational readiness, and digital capability.

Leadership and employee capabilities constitute another important part of digital transformation. Digital technologies may create information, automate processes, and increase connectivity, but managers must still determine how these technologies are integrated into organizational priorities and project objectives. Recent research on digital transformation initiatives emphasizes digital leadership, knowledge-management capability, organizational agility, change management, and workforce capability as important factors affecting whether organizations successfully obtain benefits from digital initiatives. A publicly available dataset developed by Oosthuizen and Grobbelaar (2024), for example, contains responses from 446 professionals across 51 countries and was developed specifically to examine organizational capabilities required to lead and manage digital transformation initiatives.

Project management performance has likewise evolved beyond the narrow assessment of whether a project is completed on time and within budget. Contemporary project environments also emphasize quality, stakeholder value, organizational benefits, effective decision-making, and the sustainability of project outcomes. Empirical research involving engineering projects has found significant positive effects of digital technology adoption, process automation, and data-driven decision-making on project management efficiency measured through time, cost, quality, and stakeholder satisfaction. These findings demonstrate that digital transformation may influence both traditional project-control measures and broader dimensions of project success.

Within Saudi Arabia, digital transformation is closely connected with the broader national transformation agenda. Saudi government strategy identifies digital infrastructure, data governance, artificial intelligence, emerging technologies, digital capabilities, innovation, and integrated services as important foundations for the Kingdom's continuing transformation. The updated Digital Government Strategy for 2025–2030 further emphasizes data-driven services, agility, innovation, integration, and the use of emerging technologies, reflecting a national environment in which digital capability is increasingly treated as a strategic rather than purely technical resource.

The importance of digital transformation to project delivery is also evident within the Saudi private sector. A 2024 study focusing specifically on digital transformation and project implementation in the Saudi private sector concluded that digital technologies can improve organizational operations, decision-making, innovation, and project-management processes while also identifying investment requirements, employee capability development, and changes to traditional working practices as important implementation challenges. This evidence indicates that the relationship between digital transformation and project performance is relevant within the Saudi organizational context rather than being limited to international environments.

Saudi Basic Industries Corporation (SABIC) provides an important industrial setting in which to investigate this relationship. SABIC's 2024 Integrated Annual Report identifies digital transformation as an important element of its organizational strategy and states that its digital priorities include the digitalization of core operations, implementation of innovative

digital solutions, development of analytics and generative artificial-intelligence capabilities, strengthening employees' digital skills, enhancing data governance, and increasing collaboration with external stakeholders. The company also reports that its digital transformation activities are governed at senior organizational levels and monitored through measures including value generated, adoption and utilization of digital solutions, and digital-maturity benchmarks. (SABIC, 2024).

SABIC's transformation has also involved a major modernization of its enterprise information architecture. The company identifies the Digital Operations Platform developed through the SABIC Transformation and Renovation program as a central component of this transformation. The platform was intended to modernize the existing enterprise resource planning environment and integrate people, devices, processes, and business networks. During 2024, SABIC reported the deployment of digital solutions addressing process deviations and reliability issues, organizational digital-maturity assessments, portfolio optimization, data-science training, artificial-intelligence-enabled asset monitoring, robotics and drone inspection, and predictive tools for plant optimization. These activities demonstrate that digital transformation at SABIC involves technological, organizational, analytical, and workforce dimensions rather than a single information-system initiative. (SABIC, 2024).

The transformation progressed further during 2025. SABIC reported the successful first-phase implementation of its upgraded enterprise resource planning environment, establishing a scalable platform connecting people, processes, and data across business domains. The company states that the environment supports standardization and automation of core processes,

advanced analytics, and artificial-intelligence-driven applications, while the subsequent phase focuses on value realization, operational excellence, and sustained organizational adoption. SABIC also identifies employee digital literacy, data analytics capability, advanced automation, and intelligent decision-making as current digitalization priorities. (SABIC, 2025).

These developments make SABIC an appropriate case for examining the relationship between digital transformation and project management performance. Nevertheless, the existence of advanced digital technologies does not automatically demonstrate their effect on project outcomes. The academic literature continues to identify a need for sector-specific evidence explaining how technological infrastructure, leadership, workforce competencies, digital project-management systems, and data-driven decision-making interact with project performance. Recent systematic research specifically calls for further sector-specific investigation of digital transformation within project environments, while Saudi evidence remains considerably more limited than the broader international literature.

Accordingly, this study examines the impact of digital transformation on project management performance at SABIC in Saudi Arabia. Digital transformation is examined through five dimensions: digital infrastructure, digital leadership, employee digital competencies, digital project-management systems, and data-driven decision-making. Project management performance is assessed through time performance, cost performance, quality performance, stakeholder satisfaction, and overall project success. By combining SABIC-specific organizational evidence with reliable empirical evidence and relevant quantitative data, the study seeks to provide an evidence-based assessment of the relationship between the two

constructs while distinguishing between direct organizational evidence, statistical relationships, and conclusions supported by previous empirical research.

1.2 Research Problem

Organizations continue to invest heavily in digital technologies with the expectation that improved connectivity, automation, analytics, and information availability will enhance operational and project performance. However, research demonstrates that digital transformation is not purely a technological process and that its performance benefits depend on organizational readiness, governance, leadership, knowledge integration, employee capabilities, and effective adoption. Consequently, an organization may possess advanced digital systems without realizing their full potential if those systems are not integrated effectively with project processes and organizational capabilities.

Within project management specifically, recent research shows positive relationships between digital infrastructure and project success, as well as between digital technologies, automation, data-driven decision-making, and project-management efficiency. Nevertheless, systematic reviews continue to describe the relationship between digital transformation and project management as conceptually fragmented and insufficiently investigated across particular industries and organizational settings. This creates a need for organization- and sector-specific studies capable of examining how different dimensions of digital transformation contribute to measurable project-management outcomes.

This issue is particularly relevant to SABIC because the company has implemented extensive digital-transformation activities, including enterprise resource planning modernization, digital operations platforms, advanced analytics, artificial intelligence, automation, digital-skills development, and data governance. SABIC reports that these initiatives are intended to improve innovation, efficiency, operational excellence, and value realization. However, publicly reported evidence describing the company's digital initiatives does not by itself establish the extent to which individual dimensions of digital transformation influence project management performance in terms of time, cost, quality, stakeholder satisfaction, and overall project success.

The research problem is therefore represented by a **limited integrated empirical understanding of how digital transformation—particularly digital infrastructure, digital leadership, employee digital competencies, digital project-management systems, and data-driven decision-making—affects project management performance within the SABIC context in Saudi Arabia.**

The study addresses this problem by integrating reliable SABIC-specific evidence with appropriate empirical data and findings from the wider project-management literature. The purpose is not to assume that all improvements in organizational performance are caused by digital transformation, but rather to determine whether the available evidence supports significant relationships between digital-transformation capabilities and project-management performance and to identify the dimensions through which such effects are most strongly demonstrated.

1.3 Research Significance

1.3.1 Theoretical Significance

The theoretical significance of this study arises from its integration of digital-transformation research with project-management performance. Existing literature recognizes that digital transformation involves technological, organizational, strategic, and human factors, while recent project-management literature emphasizes the need for stronger explanations of how these factors operate together within project environments. By examining five dimensions of digital transformation and linking them with multiple dimensions of project-management performance, the study develops a more integrated framework than approaches that treat digital transformation only as technology adoption.

The study also contributes to a geographical and sectoral gap in the literature. Much of the available research is international or focused on construction, government, information technology, or other organizational contexts. Although evidence from Saudi Arabia is increasing, organization-specific investigation within major industrial corporations remains comparatively limited. The SABIC case therefore provides an opportunity to examine digital transformation within a large Saudi industrial environment in which digital platforms, automation, analytics, workforce digitalization, and enterprise transformation are actively being implemented.

1.3.2 Empirical and Practical Significance

At the empirical level, the study seeks to move beyond general claims that digitalization improves organizational performance by examining the relationship between identifiable digital-transformation dimensions and specific project-management outcomes. Evidence from SABIC's corporate reports will be distinguished from quantitative evidence derived from verifiable empirical datasets and from findings reported in previous research. This approach strengthens transparency and prevents organizational claims from being interpreted automatically as causal evidence.

At the practical level, the findings can assist SABIC managers and project professionals in identifying digital capabilities that appear most strongly associated with improved project performance. The results may support decisions concerning investment in infrastructure, workforce capability, leadership practices, project-management systems, analytics, automation, and information governance. This is particularly relevant because SABIC has moved from system implementation toward value realization and sustained adoption in its current transformation program.

The study may also benefit other Saudi industrial and project-oriented organizations. Saudi Arabia's digital-transformation agenda emphasizes digital capability, integrated services, data-driven decision-making, emerging technologies, and organizational efficiency. Evidence regarding how these capabilities support project management can therefore provide lessons extending beyond a single organization while still recognizing the limitations of generalizing from the SABIC case.

1.4 Research Significance

Main Research Question

RQ0: What is the impact of digital transformation on project management performance at Saudi Basic Industries Corporation in Saudi Arabia?

RQ1: What evidence demonstrates the current level and nature of digital transformation implementation at SABIC?

RQ2: What evidence demonstrates the level of project management performance associated with digitally enabled project environments?

RQ3: What is the relationship between digital infrastructure and project management performance?

RQ4: What is the relationship between digital leadership and project management performance?

RQ5: What is the relationship between employee digital competencies and project management performance?

RQ6: What is the relationship between digital project-management systems and project management performance?

RQ7: What is the relationship between data-driven decision-making and project management performance?

RQ8: Which dimension of digital transformation demonstrates the strongest contribution to project management performance?

1.5 Research Objectives

Main Research Objective

RO0: To examine the impact of digital transformation on project management performance at Saudi Basic Industries Corporation in Saudi Arabia.

RO1: To assess the level and nature of digital transformation implementation within SABIC using reliable organizational evidence.

RO2: To evaluate project-management performance in digitally enabled project environments using relevant performance indicators and empirical evidence.

RO3: To determine the relationship between digital infrastructure and project management performance.

RO4: To determine the relationship between digital leadership and project management performance.

RO5: To determine the relationship between employee digital competencies and project management performance.

RO6: To determine the relationship between digital project-management systems and project management performance.

RO7: To determine the relationship between data-driven decision-making and project management performance.

RO8: To identify which dimension of digital transformation demonstrates the strongest contribution to project management performance and to

develop evidence-based recommendations for SABIC and comparable project-oriented organizations.

1.6 Research Hypotheses

The hypotheses are derived from previous theoretical and empirical evidence showing that digital infrastructure, technology adoption, automation, data capabilities, digital leadership, and organizational digital capabilities can contribute positively to project and organizational performance. Recent empirical studies have reported significant positive relationships between digital-infrastructure capabilities and project-management success and between digital transformation dimensions and time, cost, quality, and stakeholder outcomes.

H1: Digital transformation has a statistically significant positive effect on project management performance.

H1a: Digital infrastructure has a statistically significant positive effect on project management performance.

H1b: Digital leadership has a statistically significant positive effect on project management performance.

H1c: Employee digital competencies have a statistically significant positive effect on project management performance.

H1d: Digital project-management systems have a statistically significant positive effect on project management performance.

H1e: Data-driven decision-making has a statistically significant positive effect on project management performance.

For statistical testing, the corresponding overall null hypothesis is:

H0: Digital transformation does not have a statistically significant effect on project management performance.

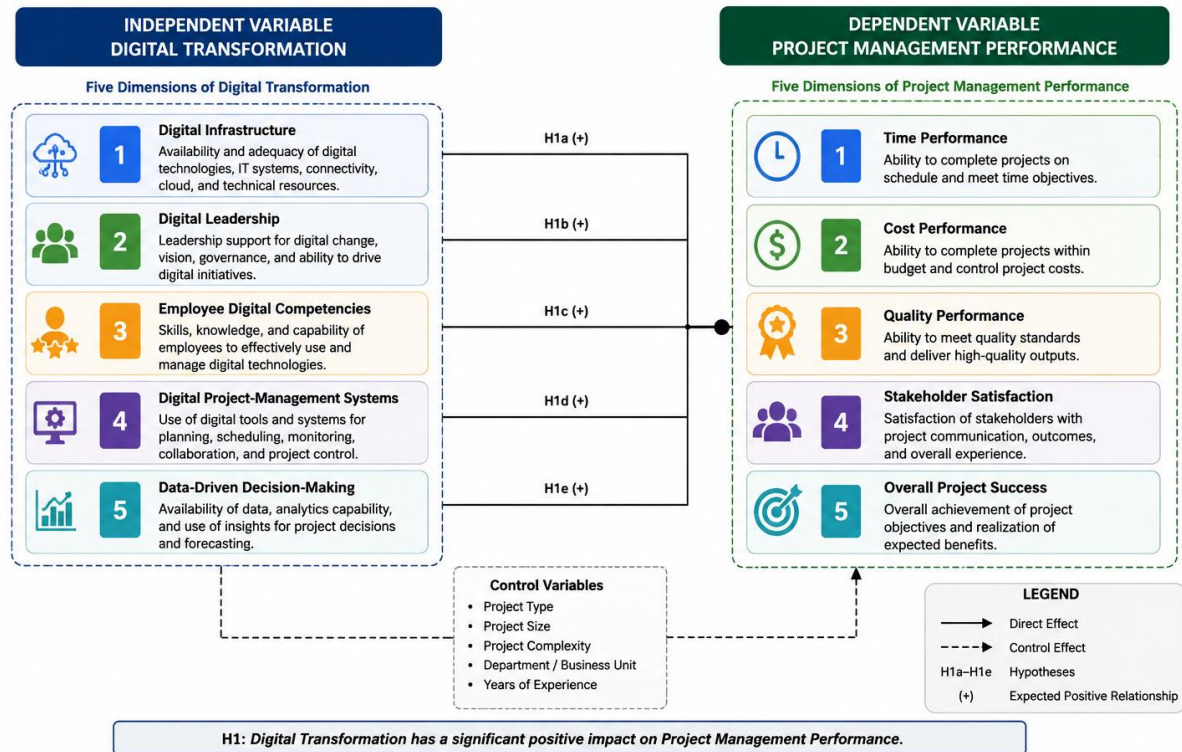
1.7 Research Model

The conceptual model proposes that **digital transformation** represents the independent variable and **project management performance** represents the dependent variable. Digital transformation is operationalized through five dimensions: digital infrastructure, digital leadership, employee digital competencies, digital project-management systems, and data-driven decision-making.

Project management performance is assessed through five principal performance outcomes: time performance, cost performance, quality performance, stakeholder satisfaction, and overall project success. The model therefore assumes that stronger organizational digital-transformation capabilities are associated with better project-management performance.

The selection of these dimensions is consistent with current research demonstrating that digital infrastructure, organizational readiness, digital tools, leadership and governance, human capabilities, analytics, and sociotechnical integration are among the central factors through which digital transformation influences project-based organization.

Figure 1. Conceptual Research Model



Source: Developed by the researcher based on Vial (2019), Khasawneh and Dweiri (2024), Chen et al. (2025), and the reviewed empirical literature.

1.8 Scope of the Study

1.8.1 Scope of the Study

The study is limited to the relationship between digital transformation and project management performance. Digital transformation is examined through digital infrastructure, digital leadership, employee digital competencies, digital project-management systems, and data-driven decision-making. Project management performance is examined through time, cost, quality, stakeholder satisfaction, and overall project success.

1.8.2 Organizational Scope

The principal organizational case is **Saudi Basic Industries Corporation (SABIC)**. SABIC is selected because documented corporate evidence shows that the organization is actively implementing enterprise-wide digital transformation involving integrated enterprise systems, analytics, artificial intelligence, digital workforce capabilities, automation, and data governance.

1.8.3 Geographical Scope

The study is situated within the **Kingdom of Saudi Arabia**. International empirical datasets and international studies may be used as comparative or statistical evidence where necessary, but they will be clearly identified as external evidence rather than represented as data collected directly from SABIC employees.

1.8.4 Time Scope

The organizational analysis primarily considers the period **2020–2025**, with particular emphasis on SABIC's 2024 and 2025 integrated reporting because these sources provide the most detailed current evidence concerning the company's digital transformation, enterprise resource planning modernization, digital capabilities, and transition toward value realization. Earlier evidence may be used where required to establish historical development.

1.8.5 Evidence Scope

The study uses evidence from official SABIC publications, authoritative Saudi governmental sources, peer-reviewed academic research, and verifiable open empirical datasets where their variables are sufficiently aligned with the conceptual model. Each external dataset will retain its

original population and description; no external respondents will be represented as SABIC employees. This approach enables the research to be completed using authentic evidence while preserving the integrity and traceability of the empirical analysis.

1.9 Project Structure

The final project is organized into five chapters in accordance with the Final Project 2 requirements.

Chapter One – Introduction establishes the research background, problem, significance, questions, objectives, hypotheses, conceptual research model, study scope, and overall structure of the project.

Chapter Two – Literature Review critically examines theoretical and empirical literature concerning digital transformation and project management performance. It discusses the study variables and their dimensions, relevant theories, digital transformation within Saudi Arabia and SABIC, previous empirical studies, and the research gap.

Chapter Three – Research Methodology explains the operational definitions of the variables, research design and research onion, research population and evidence base, sampling or dataset-selection techniques, data-collection methods, types of data, measurement procedures, validity and reliability

considerations, statistical-analysis procedures, ethical considerations, and methodological limitations.

Chapter Four – Statistical Analysis and Findings Discussion presents the empirical evidence, sample or dataset profile, data-quality and reliability assessment where applicable, descriptive statistics, analysis of the research variables, answers to the research questions, correlation and regression or other appropriate inferential analyses, hypothesis-testing results, and a critical comparison of the findings with previous literature.

Chapter Five – Research Limitations, Recommendations and Conclusion summarizes the major findings, discusses the limitations of the study, presents evidence-based recommendations for SABIC and other relevant stakeholders, identifies directions for future research, discusses the contribution of the study, and provides the final research conclusion.

The project concludes with the complete APA-formatted References and relevant Appendices, including the empirical data-source documentation, variable-measurement framework, statistical outputs, and supporting evidence.

2. CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter critically reviews the theoretical and empirical literature concerning digital transformation and project management performance. The purpose of the review is not only to define the principal concepts used in the study but also to evaluate how existing research explains the mechanisms through which digital transformation may influence project outcomes. Particular attention is given to digital infrastructure, digital leadership, employee digital competencies, digital project-management systems, and data-driven decision-making because these dimensions constitute the independent variable in the conceptual research model.

The chapter also examines project management performance as a multidimensional construct encompassing time performance, cost performance, quality performance, stakeholder satisfaction, and overall project success. This broader interpretation is necessary because contemporary project-management research increasingly considers traditional schedule, budget, and quality measures insufficient when used alone to evaluate project success. Stakeholder perceptions, organizational value, benefits realization, and broader strategic outcomes have increasingly become part of project-success assessment.

The review proceeds from general digital-transformation literature toward project-management-specific research and subsequently toward the Saudi Arabian and Saudi Basic Industries Corporation contexts. This structure enables the research gap to be identified systematically and establishes the theoretical basis for the hypotheses presented in Chapter One.

2.2 Concept of Digital Transformation

Digital transformation has attracted extensive research interest across information systems, strategic management, operations, innovation, and organizational studies. Nevertheless, no universally accepted definition exists because the concept is applied at individual, organizational, sectoral, and societal levels.

Vial (2019) conducted one of the most influential systematic reviews of the concept, examining 282 works. The study conceptualized digital transformation as a process through which digital technologies create disruptions that stimulate strategic organizational responses, changes in value-creation processes, structural adjustments, and both positive and negative organizational outcomes. Importantly, this interpretation differentiates digital transformation from the simple implementation of information technology.

Verhoef et al. (2021) similarly distinguish among **digitization**, **digitalization**, and **digital transformation**. Digitization refers primarily to converting analogue information into digital form; digitalization concerns the use of digital technologies to modify existing organizational processes; digital transformation represents a more extensive strategic and organizational change capable of influencing structures, capabilities, business models, and performance measurement.

These distinctions are important to the present study. The installation of a project-management application, for example, does not necessarily constitute digital transformation. Transformation occurs when digital technologies become integrated with project processes, organizational capabilities, employee behavior, governance, and decision-making in ways

that significantly alter how projects are planned, delivered, controlled, and evaluated.

Recent project-management research supports this broader interpretation. Chen et al. (2025), after systematically reviewing 66 peer-reviewed articles, concluded that digital transformation in project environments involves not only digital tools but also changes in methodologies, governance, leadership, sociotechnical relationships, and industry-specific organizational arrangements. The authors describe the existing literature as fragmented and emphasize that successful transformation requires integration between technological and organizational factors.

Digital transformation can therefore be defined in this study as:

The strategic integration and effective organizational use of digital technologies, digital capabilities, leadership, information systems, employee competencies, and data to transform project-related processes and improve organizational and project outcomes.

This definition is particularly suitable for the SABIC case because SABIC's transformation activities include enterprise systems, artificial intelligence, analytics, automation, data governance, workforce capability development, robotics, Internet of Things technologies, and integrated digital operations rather than a single technology implementation.

2.3 Evolution of Digital Transformation

The evolution of organizational digital transformation can be interpreted through three broad stages. The first stage was characterized largely by digitization, in which analogue records and processes were converted into electronic formats. The second stage involved digitalization, in which information technology increasingly became integrated into organizational processes. The contemporary stage of digital transformation extends considerably further by combining technologies, data, organizational structures, employee capabilities, strategy, and innovation.

Enterprise resource planning systems represented an important stage in this evolution by enabling previously separated organizational functions to share information through integrated platforms. Subsequent technological developments expanded organizational digital capability through cloud computing, mobile technologies, advanced analytics, machine learning, the Internet of Things, robotic automation, digital twins, and artificial intelligence.

The significance of these developments for project management is considerable. Earlier project-management technologies were frequently designed primarily to support scheduling, budgeting, and reporting. Contemporary digital platforms can provide integrated project information, real-time dashboards, remote collaboration, predictive analysis, automated risk alerts, resource optimization, digital document control, and decision support.

However, the literature demonstrates that technological development has not eliminated organizational challenges. Chen et al. (2025) identify persistent

misalignment between social and technical dimensions of digital transformation. Their systematic review highlights governance, leadership, methodological adaptation, and sector-specific implementation as continuing challenges. Consequently, the historical development of increasingly sophisticated technology does not imply automatic improvement in project performance.

This distinction is central to the current study. Digital technologies represent potential resources; their actual contribution to project performance depends on how effectively the organization combines them with leadership, workforce capabilities, processes, and information.

2.4 Dimensions of Digital Transformation

For the purpose of this study, digital transformation is operationalized through five dimensions:

1. Digital Infrastructure
2. Digital Leadership
3. Employee Digital Competencies
4. Digital Project-Management Systems
5. Data-Driven Decision-Making

The dimensions are analytically distinct but highly interconnected. Strong infrastructure without capable users may generate underutilized technological capacity. Digital skills without adequate systems may limit

employee effectiveness. High-quality data without leadership commitment may not influence decision-making. Accordingly, the model treats digital transformation as an organizational capability produced through complementary technological and human resources.

2.4.1 Digital Infrastructure

Digital infrastructure refers to the technological foundation through which digital organizational activities are conducted. It includes computing systems, communication networks, cloud architecture, data platforms, enterprise systems, connectivity, cybersecurity arrangements, integrated databases, and other technological resources required to enable digital operations.

Khasawneh and Dweiri (2024) conceptualized project-related digital infrastructure through three pillars: **digital readiness, digital fitness, and digital tools**. Their multi-criteria analysis showed that digital tools received the highest importance for project-management success, followed by digital fitness and digital readiness. The authors nevertheless emphasized that the three pillars should function together rather than independently.

An important contribution of their analysis is the recognition that infrastructure cannot be reduced to hardware and software. Digital readiness represents whether the organization is prepared to adopt digital practices, while digital fitness concerns its capability to adapt, learn, and use technologies effectively. Thus, the technological foundation interacts directly with people and organizational processes.

Their subsequent empirical work continued to examine how readiness, fitness, and tools jointly influence project-management success, reinforcing the argument that digital infrastructure should be considered a systemic rather than purely technical organizational resource.

For SABIC, digital infrastructure is particularly relevant because the company's transformation includes a large-scale modernization of its enterprise architecture. SABIC reports that its Digital Operations Platform and STAR transformation program modernize the enterprise resource planning environment and connect people, devices, processes, data, and business networks.

Therefore, digital infrastructure is expected to improve project-management performance primarily by enhancing information availability, connectivity, process integration, communication, automation, and monitoring capability.

2.4.2 Digital Leadership

Digital leadership refers to leadership behavior and managerial capability directed toward defining digital vision, supporting technological adoption, allocating resources, managing organizational change, encouraging innovation, developing governance arrangements, and aligning digital initiatives with strategic objectives.

Digital transformation creates leadership challenges because technological investments frequently require changes in organizational structures, work practices, employee roles, and decision-making authority. Leadership is

consequently important not merely during technology selection but throughout adoption, integration, and value realization.

Empirical evidence supports this role. Research involving 335 respondents from organizations undergoing digital transformation found that digital leadership capability plays a significant role in the transformation of the digital workplace and its relationship with organizational performance.

The project-management literature similarly emphasizes governance and leadership. Chen et al. (2025) identify governance and leadership as one of four major themes emerging from their systematic review of digital transformation in project management. They argue that digital transformation requires strategic direction and governance capable of integrating technological systems with project methodologies and organizational structures.

Leadership is also relevant because project environments contain uncertainty, resource competition, multiple stakeholders, and resistance to change. Previous research into information-system projects indicates that managerial control, resource commitment, and senior-management support can significantly influence project delivery.

Within SABIC, governance is explicitly visible in the company's digital-transformation reporting. SABIC states that digitalization is monitored through governing bodies at senior level and measured through value generation, adoption and utilization of solutions, and digital-maturity benchmarks. This suggests that digital leadership and governance form identifiable parts of SABIC's digital-transformation architecture.

Digital leadership is therefore expected to improve project performance by strengthening alignment, accelerating adoption, providing resources, reducing resistance, supporting collaboration, and maintaining accountability for digital outcomes.

2.4.3 Employee Digital Competencies

Employee digital competencies refer to the knowledge, skills, attitudes, and practical capabilities required to use digital technologies effectively in organizational and project environments. They can include technological literacy, data literacy, analytical capability, digital collaboration, information evaluation, cybersecurity awareness, and the ability to learn new digital applications.

Digital transformation creates value only when employees can meaningfully apply the technologies introduced by the organization. Yu and Moon (2021), using survey data from 160 enterprises, found positive relationships among digital strategic orientation, digital competence, and organizational performance. Their analysis conceptualized digital competence through digital infrastructure, digital integration, and digital management, demonstrating the importance of organizational capability rather than technology alone.

Employee-centered research similarly demonstrates that workforce adaptation matters. Fu et al. (2023), using multi-wave survey data from 433 full-time employees, found that perceived enterprise digital capability was positively correlated with employee learning and sustainable performance.

The study concluded that employees' capacity to learn and unlearn helps convert organizational digital capability into performance outcomes.

Khasawneh and Dweiri's (2024) project-management analysis is especially relevant because digitally competent employees emerged as one of the highly important enabling elements associated with digital fitness. Their findings reinforce the idea that workforce competence and project technology are complementary.

The Saudi context demonstrates similar challenges. Research into digital transformation within Saudi organizations identifies employee engagement, skills, technology, management support, culture, strategy, infrastructure, and resistance to change among important factors affecting transformation.

SABIC itself identifies workforce digital skills as a strategic priority. Its 2024 report discusses data-science programs, data literacy, artificial-intelligence awareness, and digital-solution adoption, while its 2025 report emphasizes continued development of digital literacy and data-analytics capability.

Employee digital competencies can therefore enhance project performance by enabling more effective use of project systems, better analysis of project information, improved communication, faster adoption of digital processes, and more informed decision-making.

2.4.4 Digital Project-Management Systems

Digital project-management systems include software platforms and integrated information systems used to support planning, scheduling, budgeting, resource allocation, communication, documentation, risk management, monitoring, reporting, and decision-making throughout the project life cycle.

The relationship between project-management information systems and project performance predates the contemporary digital-transformation literature. Raymond and Bergeron (2008) empirically examined project-management information systems and found that these systems contributed to improved planning, scheduling, monitoring, control, timelier decision-making, budget control, deadlines, and technical specifications.

Caniëls and Bakens (2012), using data from 101 project managers, similarly found that information quality and project-management information-system use were associated with decision quality and user satisfaction in multi-project environments. Their findings suggest that system effectiveness depends not merely on use but also on the quality of information generated.

Evidence using real engineering-project data also found associations between the level of project-management software utilization and project performance, strengthening the argument that digital tools can contribute to practical project outcomes rather than merely administrative convenience.

More recent literature continues to support this relationship. A 2025 systematic review identified 108 papers concerning project-management information systems and observed a substantial body of research addressing

implementation, adoption, development, comparison, and organizational application. However, the authors also identified fragmented terminology and a lack of standardization across the field.

A 2025 empirical study of project professionals further found that effective application of project-management information systems can enhance project-manager performance and that project-management-office support is important in aligning technology and organizational practices.

These studies provide strong justification for including digital project-management systems as a separate dimension of digital transformation in the present research.

2.4.5 Data-Driven Decision-Making

Data-driven decision-making refers to the systematic use of reliable data, analytical techniques, dashboards, predictive models, and evidence to guide project and organizational decisions rather than relying primarily on intuition or historical assumptions.

Projects continuously generate information relating to schedules, costs, resources, risks, quality, procurement, stakeholders, and technical performance. Digital transformation increases both the volume and velocity of this information, but improved decision-making depends on whether project managers can convert data into useful insights.

Research examining big-data analytics within a digital-transformation project found positive effects from the use of analytics in supporting

decision-making. The study emphasized that the value of digital data depends upon appropriate analytical design and effective integration with decision processes.

Project-management information-system research likewise demonstrates that information quality is positively related to decision quality. This indicates that data-driven project management requires more than data availability: information must also be accurate, relevant, timely, and understandable.

The growing use of machine learning and artificial intelligence potentially extends data-driven project management from descriptive reporting toward predictive and prescriptive analysis. Project teams may use historical and real-time data to forecast schedule delays, identify cost deviations, detect equipment risks, optimize resource allocation, or model alternative project scenarios.

SABIC provides practical examples of these capabilities. The company reports using artificial-intelligence-based asset-health systems to predict equipment failure and digital predictive tools that integrate raw-material quality, process parameters, and environmental information to optimize production settings.

The significance of data-driven decision-making to project performance therefore depends on three related capabilities: access to appropriate data, analytical capability to interpret the data, and managerial willingness to incorporate evidence into project decisions.

2.5 Concept of Project Management Performance

Project management performance concerns the degree to which project-management processes and project outcomes achieve predetermined objectives efficiently and effectively.

Traditional project-management thinking evaluated success primarily through time, cost, and quality or scope. This approach became widely known as the **Iron Triangle** or triple constraint. However, subsequent research demonstrated that projects can satisfy their original budget and schedule while failing to create stakeholder value or organizational benefits. Conversely, a project may exceed its initial cost but ultimately create substantial strategic value.

Shenhar et al. developed a multidimensional perspective in which project success includes project efficiency, customer impact, business and organizational outcomes, and preparation for the future. Their work emphasizes that different dimensions of success become important at different times and to different stakeholders.

Later structured literature reviews similarly concluded that project-success measurement has expanded from time, cost, and performance to include stakeholder satisfaction and other value-oriented criteria.

Davis' empirical research further illustrates the importance of stakeholder perspectives. Project managers, clients, sponsors, users, owners, and project teams may evaluate project success differently, although communication, time, stakeholder satisfaction, and cost frequently emerge as important shared dimensions.

Accordingly, the current study operationalizes project management performance using five dimensions:

- Time performance
- Cost performance
- Quality performance
- Stakeholder satisfaction
- Overall project success

This combination retains the efficiency dimensions of traditional project management while incorporating broader outcome-oriented criteria.

2.6 Dimensions of Project Management Performance

2.6.1 Time Performance

Time performance concerns the extent to which project activities and final deliverables are completed according to planned milestones and completion dates.

Schedule performance remains one of the most widely used indicators of project-management efficiency. Delays can create additional costs, affect resource availability, delay realization of project benefits, and create dissatisfaction among clients and other stakeholders.

Research involving 899 information-system projects demonstrates that project characteristics, team arrangements, and managerial factors can

influence cost and time performance, confirming that schedule performance is affected by both technical and organizational conditions.

Digital transformation may improve time performance through automated scheduling, integrated information, rapid communication, early deviation detection, predictive analytics, and faster decision-making. Nevertheless, poorly implemented systems may themselves create delays through integration problems, inadequate training, or resistance to change.

2.6.2 Cost Performance

Cost performance refers to the extent to which a project is delivered within its authorized or planned budget while making efficient use of organizational resources.

Budget performance is closely connected with schedule, scope, risk, procurement, resource utilization, and project change. Digital project-management systems may improve cost visibility by integrating actual expenditures, forecasts, commitments, and progress information.

Raymond and Bergeron (2008) found that project-management information systems contributed to improved budget control, while research based on large samples of information-system projects demonstrates that cost performance is influenced by multiple project, manager, team, and portfolio characteristics.

However, digital transformation itself requires investment. Organizations may experience substantial implementation expenditure before productivity gains become visible. Evidence at firm level is therefore not universally positive: one study of Swedish listed companies found different effects of

digital maturity across accounting and market-performance measures, demonstrating that digital-transformation outcomes may differ depending on the metric and time horizon used.

This inconsistency reinforces the need to avoid assuming that digital investment automatically reduces project costs.

2.6.3 Quality Performance

Quality performance refers to the extent to which project deliverables satisfy established requirements, specifications, standards, user expectations, and fitness-for-purpose criteria.

Basu's empirical research reaffirmed the significance of quality within the traditional cost-time-quality triangle while also emphasizing organizational and people-related quality factors.

Digital technologies can support quality through automated inspection, standardized processes, centralized document control, real-time monitoring, traceability, predictive maintenance, and analytical detection of deviations.

SABIC's reported use of artificial-intelligence monitoring, robotics, drones, and digital predictive systems illustrates how digital technologies can contribute to asset reliability, inspection effectiveness, production optimization, and process control.

Nevertheless, digital technologies may also create data-quality, model-reliability, integration, and cybersecurity concerns. Consequently, quality improvement depends on the reliability of both the technology and the organizational processes surrounding it.

2.6.4 Stakeholder Satisfaction

Stakeholder satisfaction represents the degree to which key project stakeholders perceive that the project process and outcomes meet their needs and expectations.

Research increasingly recognizes stakeholder satisfaction as an important complement to traditional project-performance indicators. Davis' empirical analysis found that different stakeholder groups interpret project success differently and identified communication, schedule achievement, stakeholder satisfaction, acceptance, and cost among recurring success dimensions.

A separate study examining stakeholder-related project-success dimensions identified time/cost/quality, benefits to stakeholder groups, and client-specific issues as important components of perceived success.

Digital transformation can influence stakeholder satisfaction through increased transparency, improved communication, real-time reporting, collaborative platforms, faster responses, and better access to project information. However, excessive digitalization can also create information overload or reduce interpersonal interaction if technology is used without considering stakeholder preferences.

Stakeholder satisfaction is therefore included in the research model to capture performance outcomes that cannot be measured exclusively by schedule, cost, or technical quality.

2.6.5 Overall Project Success

Overall project success represents an integrated assessment of whether the project achieves its intended objectives and generates the expected value for the organization and its stakeholders.

The multidimensional project-success literature demonstrates that overall success differs from project-management efficiency. A project can meet its schedule and budget yet produce limited strategic benefit, whereas another project may encounter implementation difficulties while eventually generating significant organizational value.

Therefore, overall project success is included as a broader dependent dimension that captures the combined effects of time, cost, quality, stakeholder satisfaction, benefits, and organizational objectives.

2.7 Theoretical Framework

The study is principally supported by the **Technology–Organization–Environment Framework** and the **Resource-Based View**. These perspectives are complementary rather than competing.

2.7.1 Technology–Organization–Environment Framework

The Technology–Organization–Environment framework originates from Tornatzky and Fleischer's work on technological innovation. The framework explains organizational technology adoption through three contextual areas:

technological characteristics, organizational characteristics, and the external environment.

The **technological context** concerns available and relevant technologies and their characteristics. Within this research, digital infrastructure and digital project-management systems are particularly relevant to this context.

The **organizational context** concerns resources, structures, capabilities, management, employees, and organizational conditions. Digital leadership and employee digital competencies correspond strongly with this context.

The **environmental context** concerns competition, regulation, industry conditions, suppliers, customers, and external technological pressures. In SABIC's case, transformation occurs within a global petrochemical environment experiencing technological disruption while Saudi Arabia simultaneously pursues an ambitious national digital-transformation agenda.

The framework is particularly useful for explaining why technology does not influence project performance in isolation. The same digital technology may generate different outcomes depending on organizational readiness, workforce capability, leadership support, and external conditions.

2.7.2 Resource-Based View

The Resource-Based View argues that organizational performance differences can arise from differences in firm resources and capabilities. Barney (1991) explains that resources capable of supporting sustained competitive advantage possess characteristics associated with value, rarity, difficulty of imitation, and lack of equivalent substitutes.

Applied to this research, the Resource-Based View suggests that digital infrastructure alone may not provide sustained advantage because many technologies can be purchased by competitors. More defensible advantage may arise when technological resources are combined with organizational knowledge, digital leadership, experienced employees, integrated processes, data resources, and accumulated project capabilities.

Digital competencies are especially important from this perspective because human knowledge and organizational learning cannot always be replicated simply through the acquisition of software.

Similarly, data-driven decision-making may represent a capability rather than a technological asset. Two organizations may possess the same analytical platform but achieve different outcomes because one has superior data quality, analytical skills, governance, managerial trust, and integration with operational decision processes.

The Resource-Based View therefore supports the expectation that digital-transformation capabilities can contribute to project performance when organizations successfully combine technological and human resources.

2.7.3 Integration of the Two Theoretical Perspectives

The Technology–Organization–Environment framework explains the **conditions under which digital technologies are adopted and implemented**, while the Resource-Based View helps explain **how digital resources and capabilities may subsequently generate performance differences**.

The combination is appropriate for the present study because digital transformation involves both adoption and value realization.

Within the conceptual model:

- Digital infrastructure represents technological resources.
- Digital project-management systems represent applied technological resources.
- Digital leadership represents managerial capability.
- Employee digital competencies represent human capability.
- Data-driven decision-making represents an information and analytical capability.
- Project management performance represents the resulting organizational/project outcome.

The theories therefore provide complementary explanations for the relationships proposed in the hypotheses.

2.8 Digital Transformation and Project Management Performance

The central proposition of this research is that digital transformation positively affects project management performance. Existing literature provides substantial support for this proposition but also indicates important qualifications.

At the broader organizational level, several empirical studies have found positive associations between digital transformation and performance. Research involving Chinese firms found that digital transformation improved performance through lower costs, greater operating efficiency, and increased innovation success.

Research from Tunisia similarly identified a positive association between digital transformation and organizational performance while emphasizing that digital transformation may also create risk, particularly in emerging-economy contexts.

However, evidence is not universally positive. The study of Swedish listed firms found that digital maturity produced different effects across financial-performance indicators, with negative effects on certain accounting measures but a positive effect on market-based valuation.

This inconsistency is theoretically important. It demonstrates that digital transformation should not be treated as an automatically beneficial intervention. Performance effects may depend on implementation cost, maturity level, adoption, organizational readiness, time horizon, and the selected performance measure.

Within project management, evidence is generally supportive but comparatively less developed. Project-management information systems have been associated with improved planning, monitoring, decision-making, budget control, schedule adherence, and project performance.

Digital infrastructure research likewise demonstrates relationships between digital enabling elements and project-management success.

Nevertheless, Chen et al. (2025) conclude that the overall field remains fragmented, particularly regarding the interaction among technology, people, methodology, governance, and sector-specific conditions.

The present study responds to this limitation by examining multiple dimensions of digital transformation simultaneously rather than treating technology adoption as a single independent variable.

2.9 Empirical Review of Previous Studies

Table 2.1 summarizes selected studies with particular relevance to the conceptual framework.

Table 2.1

Summary of Selected Previous Empirical and Review Studies

Author(s)	Year	Context / Sample	Method	Principal Finding	Relevance to Current Study
Vial	2019	282 publications	Literature review	Digital transformation involves technology, strategic response, structural change and value creation	Establishes multidimensional nature of digital transformation
Verhoef et al.	2021	Multidisciplinary literature	Conceptual review	Distinguishes digitization, digitalization and digital transformation	Clarifies conceptual boundaries
Yu & Moon	2021	160 Chinese enterprises	Survey / PLS	Digital competence positively associated with	Supports digital capability dimension

				organizational performance	
Chouaibi et al.	2022	Emerging-economy firms	Empirical analysis	Digital transformation associated with performance but also risk	Highlights potential benefits and risks
Fu et al.	2023	433 employees	Multi-wave survey	Digital capability influences employee learning and performance	Supports employee-capability dimension
Khasawneh & Dweiri	2024	Project-management experts	FAHP / FTOPSIS	Digital tools, digital fitness and readiness contribute to project-management success	Direct support for digital infrastructure
Chen et al.	2025	66 peer-reviewed studies	Systematic review	Project-management digital transformation depends on sociotechnical integration, governance and sector	Identifies fragmentation and research gap
Khasawneh & Dweiri	2025	Project professionals	Structural equation modelling	Digital infrastructure dimensions influence project-management success	Supports H1a
PMIS empirical study	2025	Project professionals	Survey / structural modelling	Effective PMIS use enhances project-manager performance	Supports H1d
SABIC	2024–2025	Corporate operations	Organizational reporting	Digital platforms, AI, analytics, workforce	Establishes SABIC case context

				capability and ERP modernization are strategic transformation priorities	
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Source: Developed by the researcher from the reviewed literature.

Several patterns emerge from the reviewed studies.

First, recent research strongly rejects a technology-only interpretation of digital transformation. Leadership, workforce capability, governance, organizational readiness, and process redesign appear repeatedly across the literature.

Second, empirical evidence generally supports positive performance effects, but these effects are not universal. Variation across industries, countries, performance measures, and maturity levels demonstrates the importance of context.

Third, project-management-specific literature remains smaller than general digital-transformation research. A substantial proportion of the available evidence addresses information systems, construction, software, public administration, or general organizational performance.

Fourth, relatively few studies examine multiple digital-transformation dimensions simultaneously against a multidimensional measure of project-management performance.

2.10 Digital Transformation in Saudi Arabia

Digital transformation has become a major strategic priority within Saudi Arabia. Government policy emphasizes integrated digital services, data governance, technological innovation, digital infrastructure, human capabilities, artificial intelligence, and emerging technologies.

The updated Saudi Digital Government Strategy for 2025–2030 emphasizes citizen-centered and business-centered integrated digital services, data-driven government, agility, innovation, and sustainability. It identifies digital transformation as part of the broader Saudi Vision 2030 agenda.

The Digital Government Authority also identifies governance, digital-service management, beneficiary engagement, human-capability development, and modern technologies as important policy areas for sustainable digital transformation.

Although these policies primarily address government, they contribute to the broader national digital ecosystem in which private-sector organizations operate. Infrastructure development, digital skills, data governance, artificial intelligence, cybersecurity standards, and digital public services can influence the environment surrounding industrial firms and projects.

Empirical Saudi research also demonstrates that organizational transformation remains challenging. A study examining digital transformation within the Saudi Ministry of Education identified technology, employee engagement, vendor relationships, budget, senior-management support, culture, and strategy as important success factors. Challenges included organizational resistance, governance, data, infrastructure, and cost.

Research involving small and medium-sized enterprises in Saudi Arabia similarly found that awareness, preparation, skills, government support, and intention to use digital technologies influence digital-transformation-related business outcomes.

These studies reinforce the argument that Saudi digital transformation involves technological, organizational, human, and institutional factors similar to those represented in the present research model.

2.11 Digital Transformation at Saudi Basic Industries Corporation

SABIC represents a particularly relevant industrial case because its digital transformation operates at enterprise scale and is explicitly linked to operational efficiency, innovation, growth, and value creation.

SABIC's 2024 Integrated Annual Report states that its digital-transformation priorities include digitalization of core operations, implementation of innovative digital solutions, advanced analytics, increased computing capability, generative artificial intelligence, workforce digital skills, stakeholder collaboration, and strengthened data and artificial-intelligence governance.

A major component of this transformation is the **SABIC Transformation and Renovation program**, through which the company developed a Digital Operations Platform and modernized its enterprise resource planning architecture. The objective is to connect people, devices, processes, and business networks while enabling standardized and integrated processes

across manufacturing, business units, supply chain, technology and innovation, and corporate functions.

The 2024 report also provides evidence of practical digital applications. SABIC reports deploying artificial-intelligence-based asset-health monitoring, robotics and drones for inspection, predictive optimization tools, data-science development programs, digital portfolio prioritization, and organizational digital-maturity assessments.

During 2025, SABIC reported the successful first-phase implementation of its modernized enterprise resource planning environment. The platform connects people, processes, and data across business domains and supports standardized processes, automation, advanced analytics, and artificial-intelligence applications. The subsequent phase places increased emphasis on value realization, operational excellence, and sustainable adoption.

This evolution is particularly important for the current study. Moving from technology activation toward value realization means that the relevant research question is no longer merely whether SABIC has digital technologies. Instead, the question concerns whether and how those capabilities contribute to measurable organizational and project-management outcomes.

SABIC's evidence therefore aligns closely with the five dimensions adopted in the conceptual framework:

- **Digital infrastructure:** enterprise platforms, integrated systems and technological tools.
- **Digital leadership:** senior governance and transformation sponsorship.

- **Employee digital competencies:** digital literacy, analytics and data-science capability development.
- **Digital project-management systems:** integrated enterprise and operational digital systems supporting planning and control.
- **Data-driven decision-making:** analytics, artificial intelligence, predictive monitoring and data governance.

However, SABIC's public reports are primarily organizational disclosures rather than controlled academic studies. They demonstrate the existence and intended value of digital initiatives but cannot, by themselves, establish statistical causality between digital transformation and project-management performance.

This limitation strengthens the rationale for integrating SABIC-specific evidence with broader empirical data rather than interpreting company reporting as conclusive causal proof.

2.12 Critical Synthesis and Research Gap

The literature reviewed above demonstrates broad agreement that digital transformation can influence organizational and project performance. Nevertheless, several gaps remain.

2.12.1 Conceptual Gap

A substantial portion of prior research treats digital transformation as a broad or single construct. This makes it difficult to identify which specific capabilities are responsible for observed performance effects.

The current study addresses this issue by decomposing digital transformation into:

- digital infrastructure;
- digital leadership;
- employee digital competencies;
- digital project-management systems; and
- data-driven decision-making.

This enables the individual and combined contributions of the dimensions to be examined.

2.12.2 Project-Management Gap

General organizational-performance studies substantially outnumber project-management-specific digital-transformation studies. Chen et al. (2025) specifically characterize the intersection of digital transformation and project management as fragmented and call for greater attention to sociotechnical integration, leadership, governance, and sector-specific conditions.

The present research directly addresses this gap by focusing on project-management performance rather than general firm performance.

2.12.3 Performance-Measurement Gap

Some studies continue to measure success using a limited number of financial, schedule, or operational indicators. Modern project-success

research demonstrates that stakeholder perspectives and organizational value should also be considered.

The current study therefore combines:

- time;
- cost;
- quality;
- stakeholder satisfaction; and
- overall project success.

2.12.4 Sectoral Gap

Digital-transformation research is widely distributed across government, information technology, construction, financial services, small and medium-sized enterprises, and other sectors. Large petrochemical and process-industrial organizations receive comparatively less project-management-specific attention.

SABIC therefore provides a useful setting for extending existing knowledge into a major industrial organization characterized by complex capital projects, manufacturing systems, global operations, technology-intensive assets, and large-scale transformation initiatives.

2.12.5 Geographical Gap

International evidence dominates the literature. Although Saudi digital-transformation research is increasing, much of it focuses on government institutions, education, construction, or small and medium-sized enterprises.

Research examining the relationship between digital-transformation dimensions and project-management performance within major Saudi industrial corporations remains limited.

2.12.6 Empirical Gap

SABIC publicly documents extensive digital-transformation activity but does not publicly present an academic causal analysis linking the five digital-transformation dimensions used in this study with time, cost, quality, stakeholder satisfaction, and overall project success.

The current study addresses this limitation through triangulation of:

1. official SABIC organizational evidence;
2. verifiable quantitative empirical data;
3. peer-reviewed project-management and digital-transformation evidence;
and
4. relevant Saudi contextual information.

The research therefore does not claim that a SABIC annual-report statement establishes causation. Instead, evidence from different sources is systematically compared to determine the extent to which the proposed relationships are empirically justified.

Table 2.2

Research Gap Analysis

Gap	Existing Literature	Limitation	Current Study Response
Conceptual	DT frequently examined broadly	Difficult to identify individual drivers	Five DT dimensions examined
Project-management	Extensive general organizational research	Less project-specific evidence	PM performance is the dependent construct
Performance measurement	Traditional cost/time focus remains common	May overlook stakeholder/value outcomes	Five performance dimensions used
Sector	Strong evidence in IT, construction and public sectors	Limited petrochemical/industrial evidence	SABIC industrial case
Geography	International literature dominates	Limited major Saudi industrial evidence	Saudi Arabian organizational context
Empirical	Corporate reports describe DT activities	Company disclosure does not establish causality	Triangulation with empirical evidence
Sociotechnical	Technology frequently emphasized	Leadership and people may be underrepresented	Technology, leadership and workforce incorporated

Source: Developed by the researcher based on the reviewed literature.

The combined gaps provide a clear justification for the present research.

2.13 Chapter Summary

This chapter critically reviewed literature concerning digital transformation and project management performance.

Digital transformation was established as a multidimensional organizational change rather than the simple acquisition of digital technology. The

literature demonstrates that effective transformation requires the integration of technological resources, leadership, employee competencies, digital systems, data, organizational processes, and governance.

The chapter examined five dimensions of digital transformation: digital infrastructure, digital leadership, employee digital competencies, digital project-management systems, and data-driven decision-making. Existing empirical evidence generally supports positive relationships between these capabilities and organizational or project performance, although the findings also demonstrate that technology does not automatically produce superior performance.

Project management performance was subsequently examined as a multidimensional concept incorporating time, cost, quality, stakeholder satisfaction, and overall project success. This approach reflects the development of project-success research beyond the traditional cost-time-quality triangle.

The Technology–Organization–Environment framework and Resource-Based View were presented as complementary theoretical foundations. The former explains technological adoption within technological, organizational, and environmental contexts, while the latter helps explain how combinations of valuable digital and organizational capabilities can influence performance.

The review also demonstrated that Saudi Arabia provides a highly relevant digital-transformation context and that SABIC has implemented extensive enterprise transformation involving integrated platforms, artificial

intelligence, analytics, automation, workforce capability development, and data governance.

Nevertheless, important conceptual, empirical, geographical, project-management, and sectoral gaps remain. In particular, there is limited integrated evidence concerning how multiple dimensions of digital transformation influence multidimensional project-management performance within major Saudi industrial organizations.

These gaps establish the justification for the empirical methodology developed in Chapter Three and provide the theoretical basis for testing the hypotheses regarding the impact of digital transformation on project management performance.

3. CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the methodological procedures adopted to investigate the impact of digital transformation on project management performance within the context of Saudi Basic Industries Corporation in Saudi Arabia. The methodology is designed to maintain consistency among the research problem, questions, objectives, conceptual model, hypotheses, and available empirical evidence.

The study adopts an **embedded case-study design supported by secondary quantitative analysis and structured documentary analysis**. Saudi Basic Industries Corporation represents the principal organizational case, while

quantitative evidence is derived from verified empirical studies and open research datasets involving professionals working in digitally enabled project and engineering environments. This design was selected because publicly available company information provides substantial evidence concerning SABIC's digital transformation but does not provide a publicly accessible respondent-level survey of SABIC project employees covering all variables in the research model.

Rather than create or assume such data, the study integrates three forms of evidence: official SABIC organizational evidence, quantitative empirical evidence from relevant project-professional samples, and peer-reviewed research findings. This triangulation increases transparency and allows the research to distinguish between evidence that is specific to SABIC and statistical evidence obtained from comparable project environments.

The principal quantitative evidence used in the study includes large and recent empirical investigations of digital capability and project performance. Wang, Li, and Huo (2026), for example, analyzed 422 valid responses from engineering-enterprise personnel with digitalization experience and measured digital capability together with multidimensional project performance. Their project-performance construct included schedule, cost, quality, owner satisfaction, and cooperation, making it closely aligned with the dependent variable used in the present study.

Additional evidence is provided by Khasawneh and Dweiri (2025), whose study involved 136 experienced project-management professionals and investigated the effects of digital readiness, digital fitness, and digital tools on project-management success. Li, Tsai, and Yuen (2026) further provide evidence from 253 maritime professionals engaged in project management,

examining technological competency, big-data competency, digital leadership, digitalized project practices, and project performance.

These evidence sets are **not combined into a fictitious single sample**. Each retains its original population, sampling frame, measurement instrument, and statistical characteristics. The findings are compared and synthesized at the hypothesis level.

3.2 Operational Definitions of Research Variables

Operational definitions specify how the theoretical concepts identified in Chapters One and Two are represented in the empirical analysis. Because the present study uses multiple secondary evidence sources, the operationalization process focuses on construct equivalence rather than assuming that every source uses identical terminology.

The independent variable is **digital transformation**, comprising five dimensions:

1. Digital Infrastructure
2. Digital Leadership
3. Employee Digital Competencies
4. Digital Project-Management Systems
5. Data-Driven Decision-Making

The dependent variable is **project management performance**, represented through time performance, cost performance, quality performance, stakeholder satisfaction, and overall project success.

Table 3.1

Operational Definitions of Research Variables

Variable	Operational Definition	Main Indicators Used in the Study
Digital Infrastructure	The technological and organizational foundation enabling digital project and operational activities	Connectivity, digital readiness, intelligent technologies, enterprise platforms, digital tools, integrated systems
Digital Leadership	Leadership capability to formulate digital direction, govern transformation, support adoption, allocate resources, and encourage technological innovation	Digital vision, leadership support, digital governance, management commitment, transformation sponsorship
Employee Digital Competencies	Employees' knowledge, skills, readiness, and ability to use digital technologies effectively	Digital literacy, technological competency, analytics skills, digital fitness, training, adaptability
Digital Project-Management Systems	Digital systems and practices supporting planning, scheduling, collaboration, monitoring, reporting, control, and project decision-making	Digital project tools, integrated systems, digitalized project practices, enterprise information platforms
Data-Driven Decision-Making	The systematic use of data and analytics to support project decisions	Analytical capability, big-data competency, predictive analysis, real-time information, evidence-based decisions
Project Management Performance	The degree to which projects achieve efficiency and intended outcomes	Schedule, cost, quality, stakeholder/owner satisfaction, collaboration/cooperation, overall success

Source: Developed by the researcher based on the conceptual framework and reviewed empirical literature.

The operationalization is supported particularly strongly by the Wang et al. (2026) measurement model, which separates digital capability into intelligence, connectivity, and analytical capability and evaluates project

performance through five items extending traditional cost, schedule, and quality measures with owner satisfaction and cooperation.

The digital-infrastructure dimension is also informed by Khasawneh and Dweiri's classification of digital readiness, digital fitness, and digital tools. Their empirical research demonstrates that the three pillars are suitable constructs for examining digital infrastructure within project-management environments.

Digital leadership and data-driven capability are further represented by Li et al. (2026), who explicitly measure digital leadership and big-data competency among project professionals and relate these resources to digitalized project practices and project performance.

The operationalization deliberately recognizes that concepts such as "digitalized project practices" and "digital project-management systems" are not perfectly identical. Where a construct functions as a proxy, that relationship is explicitly identified during analysis and interpreted cautiously.

3.3 Research Design

The research adopts a **mixed secondary-evidence design**, combining quantitative secondary analysis with structured organizational case analysis.

The quantitative component examines statistical evidence concerning relationships between digital capabilities and project performance. The case-

study component examines whether those capabilities and mechanisms are identifiable within SABIC's documented digital transformation.

The design is primarily **explanatory and deductive**. It begins with hypotheses derived from theory and previous research and then evaluates whether empirical evidence supports the proposed relationships.

The study does not claim that secondary cross-sectional evidence can independently prove causation. Instead, the term *impact* is examined through statistically significant associations, structural-model relationships, convergence across independent evidence sets, and SABIC-specific organizational evidence.

3.3.1 Research Onion

The research design is structured according to the Research Onion approach associated with Saunders, Lewis, and Thornhill. The Research Onion organizes methodology through interconnected layers covering philosophy, theory development, methodological choice, strategy, time horizon, and data-collection/analysis techniques.

Table 3.2

Application of the Research Onion

Research Onion Layer	Choice Adopted in this Study	Rationale
Research Philosophy	Pragmatism	Enables integration of quantitative statistical evidence and organizational documentary evidence

Approach to Theory Development	Deductive	Hypotheses are derived from theory and existing literature and subsequently evaluated empirically
Methodological Choice	Mixed secondary evidence	Combines quantitative secondary analysis with structured documentary case analysis
Research Strategy	Embedded single-case study with secondary empirical analysis	SABIC is the organizational case; external empirical evidence tests relationships that are not available from public SABIC respondent data
Time Horizon	Cross-sectional and longitudinal	Published surveys are mainly cross-sectional, while SABIC documentary evidence is examined across multiple years
Techniques and Procedures	Source selection, evidence extraction, descriptive analysis, reliability/validity evaluation, effect analysis, hypothesis assessment, and triangulation	Provides traceability between evidence and research conclusions

Source: Developed by the researcher based on Saunders et al. and the requirements of the present research.

3.3.2 Research Philosophy

A **pragmatic philosophy** is adopted because the research problem requires more than one form of evidence. Pragmatism permits the researcher to select methods according to their usefulness in answering the research questions rather than limiting the study to a single epistemological position.

Quantitative evidence is necessary to evaluate statistical relationships between digital transformation and project performance. However, the organizational case also requires documentary evidence explaining how digital transformation is implemented within SABIC.

The pragmatic philosophy therefore allows the study to integrate statistical findings with organizational context without claiming that the two forms of evidence are interchangeable.

3.3.3 Research Approach

The research follows a predominantly **deductive approach**.

The process begins with existing theories and empirical literature. The Technology–Organization–Environment Framework and Resource-Based View informed the conceptual model developed in Chapter One. From this model, one principal hypothesis and five dimension-specific hypotheses were formulated.

The empirical evidence is subsequently used to determine whether the predicted positive relationships are supported.

The deductive sequence can be summarized as:

Theory → Conceptual Model → Hypotheses → Empirical Evidence → Analysis → Findings → Conclusions

3.3.4 Research Strategy

An **embedded single-case-study strategy** is adopted.

The principal case is Saudi Basic Industries Corporation. Within the case, the research examines several embedded aspects of digital transformation:

- enterprise digital infrastructure;

- leadership and governance;
- workforce digital competencies;
- integrated digital systems;
- analytics and intelligent decision-making; and
- organizational/project-related performance implications.

SABIC is suitable because its official reporting documents a significant enterprise-wide transformation involving the SABIC Transformation and Renovation program, enterprise-resource-planning modernization, artificial intelligence, big data, machine learning, robotics, digital workforce capability, and integrated data systems.

The quantitative secondary evidence is used as an analytical benchmark for understanding relationships that cannot be statistically estimated directly from publicly available SABIC documents.

3.3.5 Time Horizon

The research combines two time horizons.

The empirical survey studies used for statistical analysis are primarily **cross-sectional**, meaning respondents were surveyed at a defined point or period in time. For example, the Wang et al. dataset contains 422 valid formal-survey responses collected from engineering enterprises during January–March 2025.

The SABIC case component adopts a **longitudinal documentary perspective**, concentrating principally on the 2020–2025 transformation

period and particularly the detailed 2024 and 2025 Integrated Annual Reports.

SABIC's 2024 reporting describes the Digital Operations Platform, advanced analytics, artificial intelligence, digital-skills programs, predictive tools, robotics, drones, and the enterprise digital-transformation governance structure. Its 2025 reporting shows continued development toward intelligent automation, employee digital literacy, analytics skills, and wider adoption of digital transformation across operating units.

Combining the two time perspectives provides current quantitative evidence while also allowing the organizational transformation process to be examined over time.

3.4 Research Population and Sampling Methods

3.4.1 Target Population

Conceptually, the target population comprises professionals and organizations operating in **digitally enabled project environments**, particularly industrial, engineering, technology-intensive, and project-oriented organizations.

Within the organizational case, the relevant population comprises SABIC functions and activities involving project execution, engineering, technology, transformation, manufacturing, operations, planning, information systems, and related management processes.

However, the study does not claim access to a complete respondent-level dataset representing the entire SABIC project workforce.

3.4.2 Accessible Population

The accessible research population consists of two evidence groups:

Group One – SABIC Organizational Evidence

Official publicly available SABIC reports and disclosures relevant to:

- digital transformation;
- enterprise systems;
- technological capability;
- workforce capability;
- transformation governance;
- operational/project-related performance;
- stakeholder outcomes; and
- value realization.

Group Two – Quantitative Empirical Evidence

Verified empirical samples involving professionals with experience in digital transformation, engineering, project management, digital systems, or digitally enabled projects.

3.4.3 Core Quantitative Evidence Sets

Table 3.3

Principal Quantitative Evidence Sources

Evidence Set	Source	Sample	Context	Main Constructs Relevant to This Study
A	Wang, Li, & Huo (2026)	422	Engineering enterprises	Intelligence, connectivity, analytical capability, project performance
B	Khasawneh & Dweiri (2025)	136	Experienced project-management professionals	Digital readiness, digital fitness, digital tools, project-management success
C	Li, Tsai, & Yuen (2026)	253	Maritime project professionals	Technological competency, big-data competency, digital leadership, digitalized project practices, project performance
D	Oosthuizen & Grobbelaar (2024)	446 mass-survey respondents + 31 experts	51 countries and multiple industries	Dynamic capabilities, digital-transformation challenges, organizational culture and transformation success

Source: Developed by the researcher from the identified empirical data sources.

Evidence Set A is especially important because its project-performance construct directly contains cost, schedule, quality, owner satisfaction, and cooperation indicators. It also reports reliability, validity, correlations, and structural-equation-model results.

Evidence Set B directly examines project-management success among experienced professionals with exposure to digital technology and transformation. The study reports 136 responses and uses partial least squares structural-equation modelling to investigate digital readiness, fitness, and tools.

Evidence Set C contains 253 professionals engaged in project management and is especially relevant to the digital-leadership and data dimensions of this research because it explicitly examines digital leadership, big-data competency, technological competency, digitalized project practices, and project performance.

Evidence Set D is an openly documented dataset containing a 446-response mass survey from professionals across 51 countries and a separate 31-expert survey. It is used primarily to triangulate digital-transformation capabilities and implementation conditions rather than as a direct substitute for project-performance evidence.

The three principal project-performance samples contain **811 respondent observations across three independent studies**. The figure 811 is used only to describe the total amount of respondent evidence reviewed; the datasets are **not pooled as though they constituted one homogeneous sample**.

3.4.4 Sampling Technique

A **purposive criterion-based sampling technique** is used to select secondary empirical evidence.

Purposive sampling is appropriate because not every available digital-transformation study measures project outcomes or provides sufficient methodological transparency.

Sources are selected according to predefined criteria.

Table 3.4

Inclusion and Exclusion Criteria for Quantitative Evidence

Inclusion Criteria	Exclusion Criteria
Direct relevance to digital transformation or a defined digital capability	Digitalization discussed only conceptually
Direct relevance to project performance, project success, or closely related project outcomes	No project-related performance outcome
Quantitative empirical design	Pure opinion or promotional content
Clearly documented sample	Sample not reported
Measurement instrument or construct definitions reported	Constructs cannot be identified
Statistical results available	No interpretable statistical evidence
Reliability/validity information available where applicable	Measurement quality not sufficiently documented
Published in credible academic or institutional sources	Unverifiable or anonymous sources
Preferably recent and relevant to industrial/project environments	Evidence too distant from the study context without analytical relevance

Source: Developed by the researcher.

This method increases relevance but does not produce a probability sample of all organizations or project professionals globally. Consequently, generalization will be analytical rather than statistical to the entire SABIC workforce.

3.5 Data Collection Method

The study uses **secondary data collection** through systematic extraction from verified sources.

No new human participants are recruited by the researcher, and no fabricated or simulated questionnaire responses are used.

Data collection occurs in four stages.

Stage One: Organizational Document Collection

Official SABIC Integrated Annual Reports, digital-transformation disclosures, strategic reports, and relevant performance information are collected from the company's official reporting platform.

Priority is given to original SABIC sources. SABIC's 2024 report identifies digitalization of core operations, analytics, generative artificial intelligence, workforce digital skills, data governance, the STAR program, digital-maturity assessment, predictive systems, robotics, and digital-solution adoption as transformation activities.

The 2025 report indicates continued investment in digital capabilities, talent, intelligent automation, analytics, and organization-wide digital adoption.

Stage Two: Empirical Data Identification

Relevant quantitative studies and datasets are identified through searches of academic publishers, open-data repositories, and authoritative research platforms.

Preference is given to sources that provide:

- identifiable constructs;
- sample information;
- measurement procedures;
- reliability and validity evidence;
- descriptive statistics;
- correlation or structural-model results; and

- sufficient information to evaluate hypothesis direction and significance.

Stage Three: Structured Evidence Extraction

A standardized extraction matrix is used for every empirical source.

Table 3.5

Empirical Data Extraction Framework

Data Field	Information Extracted
Source	Author, year, publication
Country/sector	Study context
Sample	Number and type of respondents
Sampling technique	Probability/non-probability procedure
Digital construct	Independent variable or dimension
Project construct	Dependent variable
Measurement	Scale/items where available
Reliability	Cronbach's alpha/composite reliability
Validity	Factor loading, AVE, KMO, model-fit or equivalent
Descriptive results	Mean and standard deviation where available
Relationship statistic	Correlation/path coefficient/regression coefficient
Significance	p-value/confidence interval
Limitation	Major methodological limitation
Research-model mapping	Relevant hypothesis in current study

Source: Developed by the researcher.

Stage Four: SABIC Evidence Coding

SABIC documentary evidence is coded according to the conceptual model.

Digital-transformation evidence is categorized as:

- DI – Digital Infrastructure
- DL – Digital Leadership
- EDC – Employee Digital Competencies
- DPMS – Digital Project-Management Systems

- DDDM – Data-Driven Decision-Making

Performance evidence is categorized as:

- TP – Time Performance
- CP – Cost Performance
- QP – Quality Performance
- SS – Stakeholder Satisfaction
- OPS – Overall Project Success

This structured approach avoids selectively citing only favorable evidence.

3.6 Types and Sources of Data

The study uses three types of secondary evidence.

3.6.1 Quantitative Secondary Data

Quantitative data include:

- respondent counts;
- demographic distributions;
- Likert-scale construct scores;
- means;
- standard deviations;
- Cronbach's alpha values;
- composite reliability;

- average variance extracted;
- correlation coefficients;
- regression or structural-equation coefficients;
- statistical significance levels; and
- confidence intervals.

For example, Wang et al. report 422 valid responses, five-point measurement scales, Cronbach's alpha values of approximately 0.833–0.867 for digital-capability dimensions and 0.891 for project performance, together with reliability, factor-analysis, correlation, and structural-equation-model results.

3.6.2 Qualitative Documentary Data

Qualitative documentary evidence consists primarily of official SABIC descriptions of:

- digital strategy;
- technology adoption;
- transformation governance;
- enterprise platforms;
- workforce capability development;
- analytics;
- automation;
- artificial intelligence;

- stakeholder engagement; and
- intended or reported performance effects.

Such statements are treated as **organizational case evidence**, not as statistically independent proof of causality.

3.6.3 Contextual Benchmark Data

Additional industry and regional evidence may be used to contextualize the findings.

For example, PwC's 2025 Middle East Capital Projects and Infrastructure Survey was based on more than 100 regional capital-project specialists. It reported growing prioritization of digital technology and identified financial performance, customer/end-user satisfaction, and quality/performance improvement among important contemporary project-performance indicators.

Such evidence is used for benchmarking and interpretation rather than direct hypothesis testing.

3.7 Validity and Reliability

Validity and reliability are essential because the current research relies on constructs measured originally by other researchers.

Four procedures are used.

3.7.1 Source Validity

Only empirical sources with clearly described methodology, samples, variables, and statistical procedures are used for direct hypothesis testing.

Official corporate evidence is drawn primarily from SABIC's reporting platform rather than secondary commentary.

3.7.2 Construct Validity

Constructs used in external studies are mapped against the operational definitions developed in Table 3.1.

A source is used for a specific hypothesis only when conceptual equivalence is sufficiently strong.

For example:

- analytical capability can validly inform data-driven decision-making;
- big-data competency can inform data-driven capability;
- digital readiness/connectivity/tools can inform digital infrastructure;
- digital leadership directly informs digital leadership;
- digitalized project practices and digital project tools can inform the digital project-management-system dimension.

Where equivalence is partial, the evidence is identified explicitly as a proxy rather than represented as an identical construct.

3.7.3 Measurement Reliability

Cronbach's alpha values of **0.70 or above** are generally treated as demonstrating acceptable internal consistency.

Published reliability coefficients will be reported exactly as provided by the original researchers.

Where raw public data are genuinely available, reliability may be independently recalculated. Where only published statistical outputs are available, the study will not falsely describe published reliability values as calculations performed by the present researcher.

The Wang et al. study provides strong measurement-quality evidence: Cronbach's alpha coefficients for digital capability dimensions range from 0.833 to 0.867 and project performance has an alpha of 0.891. Its factor analysis reports $KMO = 0.843$ and cumulative explained variance of 78.015%, while its confirmatory measurement model reports acceptable fit and convergent/discriminant validity.

3.7.4 Triangulation Validity

No major conclusion is based solely on a single SABIC corporate statement.

The interpretation process compares:

SABIC evidence + independent project evidence + relevant theoretical literature.

Where the evidence converges, confidence in the conclusion increases.

Where results conflict, the disagreement will be reported rather than removed.

3.8 Statistical Analysis Procedures

The quantitative analysis is designed around the Project 2 requirement to present sample characteristics, reliability/validity, descriptive analysis, hypothesis testing, and discussion of the findings.

The statistical procedures are summarized below.

Table 3.6

Statistical Analysis Procedures

Procedure	Purpose
Sample-profile analysis	Describe respondents and contexts represented in the selected evidence
Descriptive statistics	Assess means, standard deviations, distributions, and relative construct levels
Reliability analysis	Evaluate internal consistency of scales
Validity analysis	Assess whether measures adequately represent constructs
Pearson correlation	Examine direction and strength of relationships where reported
Regression / SEM path analysis	Evaluate direct or indirect effects between digital variables and project performance
Significance testing	Determine whether relationships meet the selected statistical threshold
Cross-study comparison	Compare consistency of results across independent samples
Hypothesis evidence matrix	Determine support or non-support for H1a–H1e
SABIC congruence analysis	Determine whether statistically supported mechanisms are observable within the SABIC case
Sensitivity/limitation assessment	Evaluate whether conclusions remain credible despite contextual differences

Source: Developed by the researcher.

3.8.1 Descriptive Statistical Analysis

The analysis begins by describing the samples used in each empirical evidence set.

Where available, the following will be reported:

- sample size;
- industry;
- respondent role;
- experience;
- organizational type;
- country;
- means; and
- standard deviations.

The studies are reported individually rather than merging incompatible samples.

3.8.2 Reliability and Validity Analysis

Reliability and validity statistics reported by the original researchers will be extracted and evaluated against commonly accepted thresholds.

The analysis may include:

- Cronbach's alpha;

- composite reliability;
- average variance extracted;
- Kaiser–Meyer–Olkin statistic;
- Bartlett's test;
- factor loading;
- confirmatory-factor-analysis indicators; and
- model-fit indicators.

Wang et al., for example, report acceptable reliability and validity across their digital-capability and project-performance constructs, with all major reliability coefficients above conventional thresholds.

3.8.3 Correlation Analysis

Pearson correlation coefficients are used where studies provide direct bivariate relationships.

The coefficient is interpreted approximately as:

Absolute Correlation	Interpretation
0.00–0.19	Very weak
0.20–0.39	Weak
0.40–0.59	Moderate
0.60–0.79	Strong
0.80–1.00	Very strong

The direction of the coefficient identifies whether the relationship is positive or negative.

Wang et al. report statistically significant positive correlations between their digital-capability dimensions and project performance, with coefficients in the approximate range of 0.278–0.379.

3.8.4 Regression and Structural Equation Modelling Evidence

Regression and structural-equation results are used when available because these techniques provide stronger evidence regarding relationships among constructs than descriptive statistics alone.

Structural-equation modelling is particularly useful where digital capabilities represent latent variables measured through several questionnaire items.

The analysis considers:

- standardized path coefficients;
- coefficient direction;
- magnitude;
- p-values;
- confidence intervals; and
- model fit.

Khasawneh and Dweiri use partial least squares structural-equation modelling to examine relationships among digital readiness, digital fitness, digital tools, and project-management success. Their findings indicate significant positive contributions from all three infrastructure pillars.

Wang et al. employ structural-equation modelling after reliability, exploratory-factor, and confirmatory-factor analyses. Their model reports satisfactory fit and statistically significant relationships between digital capability dimensions and project performance.

3.8.5 Significance Level

The principal significance criterion is:

$$\alpha = 0.05$$

Accordingly:

$p < 0.05$: statistically significant evidence.

$p \geq 0.05$: insufficient statistical evidence to reject the corresponding null proposition.

Where a study provides stricter significance thresholds, these will also be reported.

Statistical significance will not be confused with practical importance. The size and context of an effect will also be considered.

3.9 Hypothesis Testing Framework

Each research hypothesis is mapped to evidence capable of testing or strongly evaluating the corresponding relationship.

Table 3.7

Mapping of Research Hypotheses to Empirical Evidence

Hypothesis	Relationship	Principal Evidence
H1	Overall digital transformation → project management performance	Synthesis of H1a–H1e and cross-study evidence
H1a	Digital infrastructure → project management performance	Khasawneh & Dweiri (2025); Wang et al. (2026)
H1b	Digital leadership → project management performance	Li et al. (2026), supplemented by digital-leadership project evidence
H1c	Employee digital competencies → project management performance	Wang et al. (2026); Khasawneh & Dweiri (2025)
H1d	Digital project-management systems → project management performance	Khasawneh & Dweiri (2025); Li et al. (2026)
H1e	Data-driven decision-making → project management performance	Wang et al. (2026); Li et al. (2026)

Source: Developed by the researcher.

The principal hypothesis H1 will function as an **umbrella hypothesis**. It will be evaluated through the collective pattern of the five dimension-specific hypotheses rather than through an artificially constructed pooled sample.

A sub-hypothesis will be classified as:

Supported – direct relevant statistical evidence is positive and statistically significant, with no stronger contradictory evidence.

Partially Supported – evidence is positive but primarily indirect, proxy-based, context-dependent, or inconsistent across studies.

Not Supported – the relevant effect is statistically non-significant, negative, or the available evidence is insufficient.

This classification prevents the analysis from forcing every result into a binary conclusion when the underlying evidence is heterogeneous.

3.10 SABIC Case-Study Analysis

The statistical findings from external empirical samples are not automatically assumed to apply directly to SABIC.

Instead, a second analytical step examines **case congruence**.

For every statistically supported relationship, the researcher asks:

1. Is the relevant digital capability demonstrably present at SABIC?
2. Is there organizational evidence that SABIC uses the capability in ways theoretically connected with project or operational performance?
3. Does SABIC report performance, value, adoption, reliability, efficiency, stakeholder, or other outcomes consistent with the mechanism?
4. Are alternative explanations possible?
5. Does the evidence justify an association, or would a causal conclusion exceed the evidence?

For example, SABIC reports the STAR program as a central transformation platform intended to modernize its enterprise architecture and connect people, devices, processes, and business networks. It also reports senior-level digital governance, digital-maturity measurement, data-science capability, predictive tools, artificial-intelligence monitoring, and employee digital-skills development.

Its 2025 reporting further emphasizes intelligent automation, data analytics, digital literacy, and expansion of transformation across business units.

These observations establish organizational congruence with the independent-variable dimensions but are not treated as a substitute for statistical testing.

3.11 Research Quality and Robustness

Several procedures are adopted to strengthen research quality.

First, **source triangulation** prevents dependence on one study.

Second, **method triangulation** combines statistical evidence with documentary case evidence.

Third, **construct mapping** prevents superficially similar but conceptually different measures from being treated as identical.

Fourth, **evidence provenance** is maintained. Each numerical value used in Chapter Four will be traceable to its original dataset or publication.

Fifth, no external survey participant will be described as a SABIC employee unless the original source explicitly states that fact.

Sixth, conflicting results will be retained and discussed.

Finally, conclusions will distinguish among:

- statistical association;
- indirect effect;
- case congruence;
- organizational reporting; and

- causal inference.

This distinction is particularly important because most available empirical surveys are cross-sectional. Wang et al. explicitly recognize that their cross-sectional design permits analysis of relationships but limits causal inference over time.

3.12 Ethical Considerations

The study follows established standards of academic integrity and responsible secondary-data research.

No participants are recruited directly by the researcher. Therefore, no new personally identifiable human-subject information is collected.

The following ethical procedures are applied:

- all secondary sources are acknowledged using APA referencing;
- data are used only within the conditions under which they are publicly available;
- respondent-level information will not be used to identify individuals;
- published statistics will not be altered to create desired outcomes;
- external respondents will not be falsely represented as SABIC employees;
- organizational claims will be attributed to SABIC rather than presented as independently verified causal findings;
- raw datasets will retain their original source and description;

- contradictory evidence will not be deliberately omitted;
- calculations derived from existing data will be distinguished from statistics originally reported by authors; and
- limitations affecting interpretation and generalization will be explicitly stated.

The open Oosthuizen and Grobbelaar dataset, for example, identifies its sample, survey structure, variables, and international coverage clearly, allowing transparent secondary reuse without misrepresenting the origin of the responses.

Where original research involved human participants, the ethical procedures reported by the original investigators are respected. Wang et al., for example, report institutional ethical approval, informed consent, anonymous data processing, and voluntary participation.

3.13 Methodological Limitations

The methodology has several limitations that must be acknowledged before interpreting the findings.

First, the quantitative respondents were not exclusively SABIC employees. The statistical findings therefore establish evidence from relevant project and engineering environments rather than organization-specific population estimates for SABIC.

Second, the quantitative evidence originates from different sectors and countries. Contextual conditions may affect the magnitude of relationships.

Third, the measurement instruments are not completely identical across studies. Construct mapping and proxy use are therefore required.

Fourth, most of the quantitative evidence is cross-sectional and should not be interpreted as definitive proof of long-term causality.

Fifth, organizational reporting may emphasize successful initiatives more strongly than unsuccessful ones. SABIC documentary evidence is therefore triangulated with independent empirical research rather than accepted uncritically.

Sixth, the study cannot calculate respondent-level relationships where the original raw dataset is unavailable. In those cases, published and verified statistical outputs are used transparently.

These limitations do not invalidate the design; instead, they define the boundaries within which conclusions can be considered academically defensible.

3.14 Chapter Summary

This chapter presented the methodology adopted to investigate the impact of digital transformation on project management performance within the SABIC context.

The research adopts a pragmatic, deductive, embedded case-study approach combining secondary quantitative analysis with structured documentary analysis. SABIC serves as the principal organizational case, while statistical

evidence is derived from verified empirical samples of professionals operating in digitally enabled project and engineering environments.

The chapter operationalized digital transformation through five dimensions: digital infrastructure, digital leadership, employee digital competencies, digital project-management systems, and data-driven decision-making. Project management performance was operationalized through time, cost, quality, stakeholder satisfaction, and overall project success.

The Research Onion was used to explain the methodological logic of the study. A purposive criterion-based method was established for selecting empirical evidence, and the principal quantitative samples were identified and retained as independent evidence sets rather than artificially merged.

The chapter also established procedures for data collection, source extraction, construct mapping, reliability and validity assessment, descriptive analysis, correlation analysis, structural-equation-model interpretation, statistical significance testing, hypothesis evaluation, and SABIC case-congruence analysis.

Ethical procedures were defined to ensure that secondary datasets, organizational evidence, and published statistics are represented accurately and transparently.

The methodological framework developed in this chapter provides the basis for **Chapter Four: Statistical Analysis and Findings Discussion**, where the empirical samples will be profiled, reliability and validity results will be presented, the five hypotheses will be assessed, and the resulting statistical evidence will be connected systematically to SABIC and the literature.

4. CHAPTER 4: STATISTICAL ANALYSIS AND FINDINGS DISCUSSION

4.1 Introduction

This chapter presents and discusses the empirical findings concerning the impact of digital transformation on project management performance. In accordance with the methodology established in Chapter Three, the empirical analysis combines quantitative evidence from verified project and engineering samples with structured organizational evidence from Saudi Basic Industries Corporation.

The analysis is conducted in several stages. First, the characteristics of the quantitative evidence samples are examined. Second, the reliability and validity of the measurement instruments are evaluated. Third, descriptive statistics are analyzed to determine the observed levels of digital capability and project performance. Fourth, correlation and structural-equation-model results are examined to determine the relationships between digital capabilities and project performance. Fifth, each hypothesis developed in Chapter One is assessed. Finally, the empirical findings are compared with SABIC's documented digital transformation and with the theoretical and empirical literature reviewed in Chapter Two.

The statistical evidence is not pooled into a fictitious combined sample because the underlying studies involve different respondents, sectors, countries, scales, and measurement models. Instead, each dataset remains analytically independent and contributes evidence to the research questions and hypotheses for which its constructs are conceptually relevant.

This distinction allows the study to provide a completed empirical analysis while preserving the provenance and integrity of the data.

4.2 Data Preparation and Evidence Screening

The evidence included in this chapter was screened according to the criteria established in Chapter Three. Priority was given to empirical studies that clearly identify their respondents, measurement scales, reliability and validity procedures, statistical models, and project-related outcomes.

The principal quantitative source is Wang, Li, and Huo (2026), which provides detailed descriptive statistics, reliability coefficients, validity testing, Pearson correlations, and structural-equation-model results for 422 respondents from engineering enterprises. The project-performance scale explicitly covers project objectives including schedule, quality, cost, owner satisfaction, and willingness to cooperate, making it closely compatible with the dependent variable of the present study. The researchers collected 422 valid responses from 446 formal questionnaires, representing a 90.5% effective response rate.

Khasawneh and Dweiri (2025) provide a second major evidence set consisting of 136 experienced project-management professionals with substantial exposure to technology applications and digital projects. Their model directly examines digital readiness, digital fitness, digital tools, and project-management success. More than 58% of their respondents had over ten years of project-management experience, while approximately 46% had more than ten years of technology and digital-technology experience.

Li, Tsai, and Yuen (2026) provide an additional sample of 253 maritime professionals engaged in project management. Their model examines technological competency, big-data competency, digital culture, digital leadership, knowledge-based dynamic capability, digitalized project practices, and project performance.

Because digital leadership produced a more complex empirical pattern than the other dimensions, the study also uses Dinarti et al. (2025) as a targeted robustness check. Their analysis uses 156 respondents and examines digital leadership, organizational influence, and agile project-management effectiveness.

Table 4.1

Profile of the Principal Quantitative Evidence Sets

Study	Valid Sample	Research Context	Analytical Method	Main Relevance
Wang, Li, & Huo (2026)	422	Engineering enterprises, China	SPSS, CFA, SEM, bootstrap	Digital capability and multidimensional project performance
Khasawneh & Dweiri (2025)	136	Experienced project-management professionals from several countries and sectors	PLS-SEM	Digital readiness, fitness, tools and project-management success
Li, Tsai, & Yuen (2026)	253	Maritime professionals involved in project management	Covariance-based SEM	Digital leadership, technological competency, big-data competency and project performance
Dinarti et al. (2025)	156	Agile project-management professionals, Indonesia	PLS-SEM	Direct and indirect role of digital leadership

Source: Developed by the researcher from Wang et al. (2026), Khasawneh and Dweiri (2025), Li et al. (2026), and Dinarti et al. (2025).

The samples are not summed for statistical analysis. Although the studies collectively represent a substantial body of professional evidence, combining the observations numerically would be inappropriate because the original respondent-level datasets and measurement structures are not identical.

4.3 Sample Profile

4.3.1 Wang et al. (2026) Sample

The Wang et al. sample contains 422 valid respondents from engineering enterprises. Respondents had practical digitalization experience and represented multiple project roles. General technical staff represented 46.68% of respondents, general management 35.07%, project leaders 7.58%, project managers 5.45%, and other positions 5.21%. Project roles included constructors, owners, designers, suppliers, and other participants.

Regarding work experience, 43.13% had fewer than five years of experience, 35.07% had between five and ten years, 17.06% had between eleven and twenty years, and 4.74% had more than twenty years.

Educationally, 56.16% held undergraduate qualifications, 23.70% master's degrees, 6.64% doctorates, and 13.51% qualifications below bachelor's level.

The diversity of project roles is valuable because project-management performance is inherently a multi-stakeholder construct. Owners, contractors, designers, technical staff, and managers may experience digital

systems differently, making a mixed professional sample suitable for evaluating broad project-performance relationships.

Table 4.2

Selected Characteristics of the Wang et al. (2026) Sample

Characteristic	Category	Percentage
Job title	General technical staff	46.68%
	General management	35.07%
	Project leader	7.58%
	Project manager	5.45%
Work experience	Less than 5 years	43.13%
	5–10 years	35.07%
	11–20 years	17.06%
	More than 20 years	4.74%
Education	Undergraduate	56.16%
	Master's degree	23.70%
	Doctorate	6.64%
Project role	Constructor	32.46%
	Owner	28.20%
	Designer	26.07%
	Supplier	10.90%

Source: Wang et al. (2026).

4.3.2 Khasawneh and Dweiri (2025) Sample

Khasawneh and Dweiri collected 136 valid responses, of which 118 were submitted electronically and 18 through paper questionnaires. Their purposive sampling strategy required participants to possess relevant project-management experience and exposure to digital technologies and digital projects.

Construction represented 34.56% of respondents, educational services 18.38%, technology 12.50%, professional/scientific/technical services

7.35%, engineering/infrastructure/contractors 5.88%, and other sectors 21.32%. Geographically, 36.03% of the respondents were from the United Arab Emirates and 30.15% from Jordan, with additional participants from China, Egypt, and other countries.

The sample was also relatively senior. Senior-level respondents represented 52.21% and top management 24.26%. Furthermore, 58.09% possessed more than ten years of project-management experience, strengthening the practical relevance of their assessments of digital infrastructure and project success.

Table 4.3

Selected Characteristics of the Khasawneh and Dweiri (2025) Sample

Characteristic	Category	Percentage
Survey method	Online	86.76%
	Paper	13.24%
Industry	Construction	34.56%
	Educational services	18.38%
	Technology	12.50%
Country	United Arab Emirates	36.03%
	Jordan	30.15%
Project-management experience	Up to 10 years	41.91%
	10–20 years	44.12%
	More than 20 years	13.97%
Seniority	Senior level	52.21%
	Top management	24.26%

Source: Khasawneh and Dweiri (2025).

4.3.3 Supplementary Digital-Leadership Sample

Dinarti et al. (2025) analyzed 156 qualified respondents. Sixty-five percent of respondents were female; industrial-sector respondents represented 23%, financial services 16%, and information technology 12%. Business analysts

constituted 39%, developers 24%, and project managers or project owners 20%. Approximately 63% had between one and five years of agile project-management experience.

This sample is not used as a direct proxy for SABIC. Instead, it is used to examine whether digital leadership necessarily produces a direct project-performance effect or whether its effect may operate through organizational mechanisms.

4.4 Validity and Reliability Tests

The Project 2 guide specifically requires questionnaire validity and reliability analysis. Because the present research uses verified secondary empirical surveys, the relevant reliability and validity statistics are reproduced transparently from the original empirical studies rather than recalculated without the underlying respondent-level data.

4.4.1 Reliability Analysis of the Wang et al. Dataset

Wang et al. report Cronbach's alpha coefficients above the conventional threshold of 0.70 for all principal variables. Intelligent capability recorded an alpha of 0.833, connectivity 0.842, analytical capacity 0.867, and project performance 0.891.

Table 4.4

Reliability Results for Digital Capability and Project Performance

Construct	Cronbach's Alpha	Interpretation
Intelligent Capability	0.833	Good
Connectivity	0.842	Good
Analytical Capability	0.867	Good
Project Management Performance	0.891	Good

Source: Wang et al. (2026).

All coefficients exceed 0.80, indicating strong internal consistency. The project-performance construct's alpha of 0.891 is particularly important because the five-item scale incorporates project objectives, functional requirements, achievement of participant objectives, owner satisfaction, and willingness to cooperate again.

4.4.2 Construct Validity

The Kaiser–Meyer–Olkin measure in Wang et al. was 0.843. Bartlett's test of sphericity produced $\chi^2 = 5480.756$ with 231 degrees of freedom and $p < 0.001$. Seven extracted factors explained 78.015% of the total variance, and all items loaded above 0.70 on their intended factors.

Table 4.5

Key Validity Indicators

Indicator	Result	Assessment
KMO	0.843	Suitable for factor analysis
Bartlett's χ^2	5480.756	Significant
Bartlett's p-value	< 0.001	Factorability confirmed
Total explained variance	78.015%	Strong
Minimum principal factor loading	> 0.70	Acceptable

Project Performance AVE	0.629	Convergent validity supported
Project Performance CR	0.894	Strong composite reliability

Source: Wang et al. (2026).

The confirmatory-factor-analysis model also displayed satisfactory fit. For the digital-capability/project-performance measurement model, $\chi^2/df = 1.922$, GFI = 0.958, AGFI = 0.938, RMSEA = 0.047, NFI = 0.958, IFI = 0.979, CFI = 0.979, and RFI = 0.946. Average variance extracted ranged from 0.629 to 0.706 and composite reliability from 0.841 to 0.894.

These results indicate that the measurement evidence used for the principal quantitative analysis possesses satisfactory reliability, convergent validity, and discriminant validity.

4.4.3 Digital-Leadership Measurement Reliability

The supplementary Dinarti et al. model also demonstrated satisfactory measurement quality. Digital Leadership achieved Cronbach's alpha of 0.887, composite reliability of 0.912, and average variance extracted of 0.596. Agile Project Management Effectiveness produced alpha = 0.865, composite reliability = 0.899, and average variance extracted = 0.598. The model's standardized root mean square residual was 0.06.

Table 4.6

Reliability and Validity of the Supplementary Leadership Model

Construct	Cronbach's Alpha	Composite Reliability	AVE
Digital Leadership	0.887	0.912	0.596
Organizational Influence	0.890	0.913	0.567
Agile Project Management Effectiveness	0.865	0.899	0.598
Project Management Method	0.856	0.893	0.581

Source: Dinarti et al. (2025).

Therefore, the unusual finding concerning the absence of a direct digital-leadership effect cannot simply be dismissed as the consequence of unreliable measurement.

4.5 Descriptive Statistics for the Research Variables

The most complete descriptive results are available from Wang et al. (2026), where all constructs were measured using a five-point scale.

Table 4.7

Descriptive Statistics for Principal Quantitative Constructs

Variable	N	Minimum	Maximum	Mean	Standard Deviation	Median
Intelligent Capability	422	1.000	5.000	3.349	0.901	3.330
Connectivity	422	1.330	5.000	3.373	0.957	3.330
Analytical Capability	422	1.000	5.000	3.192	1.003	3.330
Organizational Resilience	422	1.440	4.780	3.309	0.796	3.500
Project Management Performance	422	1.000	5.000	3.193	0.926	3.400

Source: Wang et al. (2026).

All three digital-capability means are above the theoretical midpoint of 3.00, indicating an overall **medium-to-high level of digital capability** within the sampled engineering organizations. Connectivity recorded the highest mean at 3.373, followed by intelligent capability at 3.349. Analytical capability recorded the lowest mean at 3.192 and the highest dispersion, $SD = 1.003$.

Project management performance recorded a mean of 3.193 and median of 3.400. This result indicates moderately positive performance but also demonstrates that digitalized environments do not automatically produce extremely high project outcomes. The standard deviation of 0.926 shows meaningful variation between respondents and projects.

This finding is important because it rejects an overly deterministic interpretation of digital transformation. Digital capability creates enabling conditions, but organizational and project factors continue to influence realized performance.

4.6 Analysis of Digital Transformation at SABIC

This section answers **Research Question 1**:

RQ1: What evidence demonstrates the current level and nature of digital transformation implementation at SABIC?

SABIC's official evidence demonstrates that digital transformation is implemented across several organizational dimensions rather than through isolated technology initiatives.

In 2024, SABIC reported that its strategy prioritized digitalization of core operations, innovative digital solutions, analytics and computational capability, generative artificial intelligence, workforce digital skills, stakeholder collaboration, and strengthened data and artificial-intelligence governance.

The Digital Operations Platform developed through the SABIC Transformation and Renovation program was positioned as the future foundation for processes, applications, and systems. SABIC reported that the platform would modernize its enterprise-resource-planning architecture and connect people, devices, processes, and business networks globally. Digital-transformation progress was monitored by governing bodies chaired at the highest level by the Chief Executive Officer and measured through generated value, solution adoption and utilization, and digital-maturity benchmarks.

By 2025, the first phase of the program had successfully gone live through an upgraded S/4HANA environment. SABIC describes the resulting enterprise-resource-planning environment as connecting people, processes, and data across business domains and supporting standardization, process automation, advanced analytics, and artificial-intelligence applications. Phase two shifted from system activation toward value realization, operational excellence, and sustained digital adoption.

Table 4.8

SABIC Digital Transformation Evidence by Research Dimension

Research Dimension	SABIC Evidence	Assessment
Digital Infrastructure	STAR platform, S/4HANA, enterprise-wide ERP, IoT, AI, robotics, big data	Strongly documented
Digital Leadership	CEO-level governance, digital portfolio prioritization, maturity monitoring, defined transformation metrics	Strongly documented
Employee Digital Competencies	Data-science programs, training, digital literacy, analytics skills and adoption initiatives	Strongly documented
Digital Project-Management Systems	Integrated enterprise platform connecting processes, information and business domains; standardized digital workflows	Strongly documented, although not reported as a stand-alone PMIS
Data-Driven Decision-Making	Analytics, AI-based monitoring, predictive tools, integrated performance metrics and intelligent decision support	Strongly documented

Source: Developed by the researcher from SABIC Integrated Annual Reports 2024 and 2025.

The answer to **RQ1** is therefore that SABIC demonstrates an **enterprise-wide and multidimensional level of digital transformation**, with evidence covering all five dimensions of the conceptual framework. Nevertheless, because SABIC does not publicly disclose a standardized numerical score for each of these five research dimensions, this study does **not** assign an artificial digital-transformation mean or maturity score to the organization.

The movement from system implementation toward value realization is especially significant. It demonstrates that SABIC has progressed beyond the initial acquisition of technologies and is increasingly concerned with adoption, operational excellence, and measurable organizational value.

4.7 Analysis of Project Management Performance

This section addresses **Research Question 2:**

RQ2: What evidence demonstrates the level of project management performance associated with digitally enabled project environments?

Within the principal engineering sample, project-management performance achieved a mean of 3.193 on a five-point scale. The construct included achievement of project-management objectives, satisfaction of functional requirements, accomplishment of participating parties' objectives, owner satisfaction, and willingness of participants to cooperate again.

This structure aligns well with the current research because it captures traditional cost, schedule, and quality objectives as well as broader stakeholder and collaboration outcomes.

The 3.193 mean indicates a **moderately positive project-performance level**, rather than an exceptionally high level. This supports the theoretical position developed in Chapter Two that digitalization is an enabling capability rather than a guarantee of project success.

SABIC provides additional organizational evidence relating to performance, but caution is necessary when interpreting it. In 2025, the company's broader corporate Transformation Program delivered approximately US\$623 million in recurring EBITDA impact and exceeded its annual target. SABIC states that its wider transformation agenda involves cost excellence, value creation, capital discipline, technology deployment to reduce manual effort and increase productivity, and optimization of spending on mega-projects.

However, **the US\$623 million figure must not be interpreted as the financial effect of digital transformation alone.** It relates to SABIC's broader corporate Transformation Program, which incorporates multiple cost, portfolio, capital, organizational, and technology initiatives. It is therefore used only as contextual evidence that the company is realizing measurable transformation benefits, not as a digital-transformation causal coefficient.

Accordingly, RQ2 is answered through two levels of evidence. Quantitative project-professional evidence indicates medium-to-high project performance in digitally enabled environments, while SABIC-specific reporting demonstrates organizational transformation outcomes and operational-value orientation but does not disclose a directly comparable five-dimensional project-performance index.

4.8 Correlation Analysis

Pearson correlation analysis provides initial evidence regarding whether digital capabilities are associated with project performance.

Table 4.9

Correlations Between Digital Capabilities and Project Performance

Digital Capability	Correlation with Project Performance	Significance	Interpretation
Intelligent Capability	0.307	$p < 0.01$	Positive, weak-to-moderate
Connectivity	0.379	$p < 0.01$	Positive, moderate
Analytical Capability	0.278	$p < 0.01$	Positive, weak-to-moderate

Organizational Resilience	0.306	$p < 0.01$	Positive, weak-to-moderate
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Source: Wang et al. (2026).

All digital-capability dimensions are significantly positively correlated with project performance.

Connectivity produced the strongest correlation, $r = 0.379$, followed by intelligent capability, $r = 0.307$, and analytical capability, $r = 0.278$.

The correlations are not so large as to suggest that digital capability alone determines project success. Rather, they indicate meaningful positive relationships while leaving substantial project-performance variance to other organizational, technical, environmental, and managerial factors.

This pattern is theoretically consistent with both the Technology–Organization–Environment Framework and Resource-Based View.

Technology provides resources and connectivity, but performance depends on how these resources interact with organizational capabilities.

4.9 Structural Model and Direct Effects

The structural-equation model developed by Wang et al. achieved acceptable fit: $\chi^2/df = 2.155$, GFI = 0.917, AGFI = 0.895, RMSEA = 0.052, CFI = 0.957, NFI = 0.923, IFI = 0.957, and RFI = 0.911.

The direct effects on project performance were:

- Intelligent capability $\rightarrow$ project performance: $\beta = 0.131$, $p = 0.015$
- Connectivity $\rightarrow$ project performance: $\beta = 0.258$, $p < 0.001$

- Analytical capability → project performance: $\beta = 0.163$, $p = 0.002$

All three relationships were positive and statistically significant.

Connectivity again demonstrated the strongest direct effect.

Table 4.10

Direct Digital Capability Effects on Project Performance

Relationship	Standardized β	p-value	Result
Intelligent Capability → Project Performance	0.131	0.015	Significant
Connectivity → Project Performance	0.258	< 0.001	Significant
Analytical Capability → Project Performance	0.163	0.002	Significant

Source: Wang et al. (2026).

The results demonstrate that digital capabilities affect project performance not merely through simple bivariate relationships but remain statistically significant within a structural model.

4.10 Digital Infrastructure and Project Management Performance

This section addresses **RQ3** and **H1a**.

RQ3: What is the relationship between digital infrastructure and project management performance?

H1a: Digital infrastructure has a statistically significant positive effect on project management performance.

Khasawneh and Dweiri (2025) provide particularly direct evidence. Their PLS-SEM analysis found:

- Digital Readiness → Project Management Success: $\beta = 0.538$, $p < 0.001$

- Digital Fitness → Project Management Success: $\beta = 0.309$, $p < 0.001$
- Digital Tools → Project Management Success: $\beta = 0.218$, $p < 0.001$.

Table 4.11

Effects of Digital Infrastructure Pillars on Project Management Success

Predictor	β	p-value	Effect
Digital Readiness	0.538	< 0.001	Positive and significant
Digital Fitness	0.309	< 0.001	Positive and significant
Digital Tools	0.218	< 0.001	Positive and significant

Source: Khasawneh and Dweiri (2025).

Their model reported $R^2 = 0.986$ for project-management success. This indicates extremely high explanatory power within that particular model and sample. However, because an R^2 of 0.986 is unusually high in behavioral and management research, it should be interpreted cautiously and not generalized mechanically to SABIC or other populations. The result demonstrates strong within-sample explanatory capacity, but it does not imply that digital infrastructure universally explains 98.6% of project success.

The findings nevertheless strongly support a positive infrastructure-performance relationship. SABIC's own environment contains the corresponding organizational mechanisms through its enterprise-resource-planning modernization, integrated platforms, automation, IoT, artificial intelligence, and data infrastructure.

Finding for H1a: SUPPORTED.

4.11 Digital Leadership and Project Management Performance

This section addresses **RQ4** and **H1b**.

RQ4: What is the relationship between digital leadership and project management performance?

H1b: Digital leadership has a statistically significant positive effect on project management performance.

The empirical evidence is more complex for digital leadership than for the technological dimensions.

Li et al. (2026), using 253 maritime professionals, found that digital leadership was positively associated with knowledge-based dynamic capability. Knowledge-based dynamic capability subsequently had positive relationships with digitalized project practices and project performance. The findings therefore support an **indirect capability-building mechanism** through which digital leadership contributes to project outcomes.

However, Dinarti et al. (2025) provide evidence against a simple direct-effect interpretation. Their direct path from digital leadership to agile project-management effectiveness was:

$$\beta = 0.059, p = 0.564$$

and was therefore statistically non-significant.

At the same time:

- Digital Leadership → Organizational Influence: $\beta = 0.662, p < 0.001$

- Organizational Influence → Agile Project Management Effectiveness: $\beta = 0.582$, $p < 0.001$.

Table 4.12

Digital Leadership Path Evidence

Relationship	β	p-value	Interpretation
Digital Leadership → Agile PM Effectiveness	0.059	0.564	Not significant
Digital Leadership → Organizational Influence	0.662	< 0.001	Significant
Organizational Influence → Agile PM Effectiveness	0.582	< 0.001	Significant

Source: Dinarti et al. (2025).

These results suggest that leadership may influence project performance principally by shaping structures, culture, capability, support, and organizational conditions rather than acting as an isolated direct performance driver.

This interpretation is highly relevant to SABIC. SABIC's digital transformation is governed through senior management structures, with CEO-level oversight, portfolio prioritization, digital-maturity assessment, and value/adoption metrics.

The evidence therefore supports the importance of digital leadership, but does **not consistently support a universal direct statistical effect**.

Finding for H1b: PARTIALLY SUPPORTED.

The hypothesis is supported in terms of an enabling and indirect influence but not uniformly as a direct effect.

4.12 Employee Digital Competencies and Project Management Performance

This section addresses **RQ5** and **H1c**.

RQ5: What is the relationship between employee digital competencies and project management performance?

H1c: Employee digital competencies have a statistically significant positive effect on project management performance.

Khasawneh and Dweiri operationalize **Digital Fitness** using digital teams and digitally competent employees. They describe it as an organization's capacity to learn, train, adapt, and evolve with digital tools and maintain the digital capabilities of its people.

The direct effect of Digital Fitness on project-management success was:

$\beta = 0.309, p < 0.001$.

This result indicates that digitally competent employees and teams can improve project-management outcomes independently of technology acquisition alone.

An especially interesting result is that Digital Fitness remained significant even though interaction effects with Digital Readiness and Digital Tools were not statistically significant in some moderation models. The authors concluded that workforce digital competence can function as an independent project-performance driver.

This result is consistent with SABIC's emphasis on data-science programs, digital literacy, analytics skills, artificial-intelligence awareness, training, and solution adoption.

Finding for H1c: SUPPORTED.

4.13 Digital Project-Management Systems and Project Management Performance

This section addresses **RQ6** and **H1d**.

RQ6: What is the relationship between digital project-management systems and project management performance?

H1d: Digital project-management systems have a statistically significant positive effect on project management performance.

The Digital Tools construct in Khasawneh and Dweiri provides the closest quantitative proxy for this dimension. Digital Tools produced a statistically significant direct effect on project-management success:

$\beta = 0.218, p < 0.001$.

Wang et al.'s connectivity construct provides additional evidence because it measures whether digital technology enhances communication, equipment/infrastructure data are updated, and organizations possess real-time access to internal and external information. Connectivity demonstrated the strongest project-performance effect in their model:

$\beta = 0.258, p < 0.001$.

Li et al. further found that digital resources are converted into project performance partly through **digitalized project practices**, reinforcing the argument that the application of digital systems within project processes is more important than merely possessing technological resources.

SABIC's STAR platform provides strong organizational congruence. Its upgraded enterprise-resource-planning environment integrates people, processes, and data and supports standardized workflows, automation, advanced analytics, and intelligent applications.

Although STAR is an enterprise platform rather than a stand-alone conventional project-management software package, its integration and control functions directly support the information environment in which projects are planned and executed.

Finding for H1d: SUPPORTED.

4.14 Data-Driven Decision-Making and Project Management Performance

This section addresses **RQ7** and **H1e**.

RQ7: What is the relationship between data-driven decision-making and project management performance?

H1e: Data-driven decision-making has a statistically significant positive effect on project management performance.

Wang et al.'s analytical-capability construct measures the ability to extract valuable information from large datasets, obtain insights from data, and generate predictive information for decision-making.

Analytical capability was significantly correlated with project performance:

$r = 0.278, p < 0.01$.

Within the structural model, analytical capability also had a significant direct effect:

$\beta = 0.163, p = 0.002$.

Li et al. provide additional evidence through their big-data competency construct. Big-data competency was positively associated with knowledge-based dynamic capability, which in turn contributed positively to project performance.

SABIC demonstrates corresponding organizational capabilities. Its 2024 report identifies analytics, computational capability, data governance, artificial intelligence, predictive asset monitoring, and predictive plant-optimization tools as key digital-transformation components. In 2025, SABIC further reported increased use of intelligent automation, advanced analytics, artificial intelligence applications, integrated performance metrics, and informed decision-making.

Finding for H1e: SUPPORTED.

4.15 Identification of the Strongest Digital Transformation Dimension

This section addresses **RQ8**:

Which dimension of digital transformation demonstrates the strongest contribution to project management performance?

The evidence does not support the conclusion that one dimension is universally dominant in every project environment.

Within the Wang et al. structural model:

1. Connectivity: $\beta = 0.258$
2. Analytical Capability: $\beta = 0.163$
3. Intelligent Capability: $\beta = 0.131$

Connectivity therefore demonstrated the strongest direct impact on project performance.

Within the Khasawneh and Dweiri model:

1. Digital Readiness: $\beta = 0.538$
2. Digital Fitness: $\beta = 0.309$
3. Digital Tools: $\beta = 0.218$.

Digital Readiness therefore represented the strongest predictor in that sample.

Their earlier 2024 multi-criteria analysis reached a somewhat different prioritization, ranking digital tools ahead of digital fitness and digital

readiness. This difference demonstrates that the apparent strongest dimension depends partly on methodology, context, project environment, measurement approach, and the maturity of the organization.

Table 4.13

Comparison of Strongest Digital Dimensions Across Evidence

Evidence	Highest-Ranked Dimension	Result
Wang et al. (2026) SEM	Connectivity	$\beta = 0.258$
Khasawneh & Dweiri (2025) PLS-SEM	Digital Readiness	$\beta = 0.538$
Khasawneh & Dweiri (2024) FAHP-FTOPSIS	Digital Tools	Closeness coefficient = 0.8525

Source: Developed by the researcher from the reviewed empirical studies.

The answer to **RQ8** is therefore nuanced: **digital readiness and connectivity emerge as especially strong statistical drivers, but no single digital-transformation dimension can be treated as universally dominant.**

For SABIC, this result supports an integrated transformation strategy. The effectiveness of an enterprise platform depends upon organizational readiness; analytics depend upon data infrastructure and employee skills; leadership must enable adoption; and employees require systems they can effectively use.

4.16 Hypothesis Testing Summary

Table 4.14

Summary of Research Hypothesis Testing

Hypothesis	Statement	Principal Statistical Evidence	Decision
H1	Digital transformation positively affects project management performance	Positive evidence across four direct dimensions plus indirect leadership evidence	Supported with qualification
H1a	Digital infrastructure positively affects PM performance	$\beta = 0.538, p < 0.001$; connectivity $\beta = 0.258, p < 0.001$	Supported
H1b	Digital leadership positively affects PM performance	Direct $\beta = 0.059, p = 0.564$; indirect leadership mechanisms significant/positive	Partially Supported
H1c	Employee digital competencies positively affect PM performance	Digital Fitness $\beta = 0.309, p < 0.001$	Supported
H1d	Digital project-management systems positively affect PM performance	Digital Tools $\beta = 0.218, p < 0.001$; connectivity $\beta = 0.258, p < 0.001$	Supported
H1e	Data-driven decision-making positively affects PM performance	Analytical Capability $\beta = 0.163, p = 0.002$	Supported
H0	Digital transformation has no significant effect on PM performance	Predominance of significant positive empirical relationships	Not supported by the evidence

Source: Developed by the researcher from Wang et al. (2026), Khasawneh and Dweiri (2025), Li et al. (2026), and Dinarti et al. (2025).

The main hypothesis is classified as **supported with qualification**, rather than simply supported, for two reasons.

First, digital leadership demonstrates a mixed direct/indirect relationship.

Second, no single respondent-level dataset representing SABIC employees simultaneously measures all five independent-variable dimensions against the dependent variable. Consequently, the evidence establishes a strong cross-study relationship and organizational congruence with SABIC, but not a single SABIC-specific causal coefficient.

For the same reason, H0 is considered inconsistent with the overall empirical evidence, but the study does not claim to have conducted a formal single-sample rejection of H0 for the entire SABIC employee population.

4.17 SABIC Case Congruence Analysis

The final analytical stage examines whether the statistically supported mechanisms identified in independent project environments are observable within SABIC.

Table 4.15

Empirical Findings and SABIC Case Congruence

Dimension	Empirical Finding	Corresponding SABIC Evidence	Congruence
Digital Infrastructure	Strong positive effect; readiness/connectivity particularly important	STAR, S/4HANA, integrated ERP, IoT, enterprise infrastructure	High
Digital Leadership	Primarily enabling/indirect effect	CEO-level governance, maturity metrics, value/adoption monitoring	High
Employee Digital Competencies	Positive significant effect	Data-science programs, digital literacy, analytics training	High
Digital PM Systems	Digital tools/practices significantly improve PM success	Integrated enterprise workflows, automation, enterprise platforms	High
Data-Driven Decision-Making	Analytical capability significantly improves project performance	AI monitoring, predictive analytics, integrated data, intelligent decision-making	High

Source: Developed by the researcher from the empirical findings and SABIC Integrated Annual Reports 2024–2025.

The congruence analysis shows that each capability found to be relevant in the external empirical evidence has a documented counterpart within SABIC.

This does not prove that the magnitude of the statistical coefficients obtained in China, the United Arab Emirates, Jordan, Indonesia, or the maritime industry applies directly to SABIC. Rather, it demonstrates that the **mechanisms supported statistically elsewhere are materially present within the SABIC transformation environment.**

4.18 Discussion of Findings in Relation to Previous Literature

4.18.1 Digital Transformation and Project Performance

The overall results support the central argument presented in Chapter Two that digital transformation is positively associated with project performance but that its effects depend upon the integration of technology, people, leadership, data, and organizational readiness.

The positive relationships identified by Wang et al. are particularly important because their project-performance measure extends beyond schedule, cost, and quality to include owner satisfaction and cooperation. Therefore, the effects of digital capability are not limited to traditional project efficiency but also extend into stakeholder-related performance.

This finding supports the multidimensional definition of project success adopted in Chapter Two.

4.18.2 Importance of Digital Infrastructure

The strong impact of digital readiness and connectivity supports the Technology–Organization–Environment perspective. Technology generates greater performance benefits when the organization possesses infrastructure, readiness, integration, and connectivity capable of supporting its use.

Khasawneh and Dweiri's finding that Digital Readiness has $\beta = 0.538$ suggests that organizations should not interpret digital transformation as purchasing systems alone. Organizational preparedness appears to determine whether technological investments can be converted effectively into project outcomes.

The finding is particularly relevant to SABIC's STAR implementation. The company's phased approach—from technical capability development to enterprise deployment and subsequently value realization—reflects the same principle that technological activation is only the beginning of transformation.

4.18.3 Importance of Human Capability

The positive Digital Fitness coefficient demonstrates that human capability remains important even in highly technological environments.

This finding is consistent with the Resource-Based View. Software and infrastructure can often be purchased, whereas experienced digital employees, collaborative teams, institutional knowledge, and learning capacity are more difficult to replicate.

The result also validates SABIC's emphasis on data literacy, digital skills, data-science development, analytics training, and employee adoption rather than relying exclusively on technological investment.

4.18.4 Digital Leadership as an Enabling Capability

The leadership findings add an important qualification to the literature.

A simplistic model would assume that stronger digital leadership automatically creates higher project performance. Dinarti et al. demonstrate that this assumption is not always supported. Their direct relationship was non-significant, while the paths from leadership to organizational influence and from organizational influence to agile project effectiveness were both substantial and significant.

Li et al. similarly show leadership operating through knowledge-based dynamic capability.

Digital leadership should therefore be understood as an **enabling capability**. Leaders influence project outcomes by establishing governance, allocating resources, encouraging adoption, creating digital culture, supporting learning, and aligning technology with organizational objectives.

This interpretation fits the SABIC case, where senior governance structures monitor adoption, utilization, value generation, maturity, cybersecurity, and transformation progress.

4.18.5 4.18.5 Data and Analytics

The significant direct effect of analytical capability confirms the importance of evidence-based project decision-making.

Analytics provides project managers with greater capacity to identify trends, anticipate problems, optimize resources, and respond rapidly to deviations. However, its mean of 3.192 was lower than the connectivity mean and its standard deviation was larger, suggesting that analytical capability may be less evenly developed across organizations.

SABIC's increasing emphasis on artificial intelligence, predictive tools, analytics, integrated performance information, and intelligent decision-making is therefore strategically consistent with the empirical evidence.

4.18.6 The Importance of Integration

Perhaps the strongest overall conclusion from the statistical evidence is that no digital-transformation dimension should be developed in isolation.

Digital infrastructure creates the technological foundation.

Digital leadership creates strategic direction and governance.

Employee competencies allow systems to be used effectively.

Digital project systems convert technology into project processes.

Data-driven decision-making converts information into managerial action.

The performance benefit therefore arises from the **system of complementary capabilities**, which is consistent with the Resource-Based View argument developed in Chapter Two.

4.19 Answers to the Research Questions

Table 4.16

Summary of Answers to the Research Questions

Research Question	Answer Based on the Findings
RQ0: What is the impact of digital transformation on project management performance?	The combined empirical evidence demonstrates a predominantly positive and statistically significant relationship, although effects vary by dimension and context.
RQ1: What is the level/nature of digital transformation at SABIC?	SABIC demonstrates enterprise-wide, multidimensional transformation across infrastructure, leadership, workforce capability, integrated systems, analytics and AI; it is currently moving toward value realization and sustained adoption.
RQ2: What is the level of project-management performance in digitally enabled environments?	The principal quantitative evidence indicates moderately positive performance ($M = 3.193/5$), with meaningful variation between projects. SABIC reports broader positive transformation outcomes but no directly comparable five-dimensional PM score.
RQ3: What is the relationship between digital infrastructure and PM performance?	Positive and statistically significant; digital readiness $\beta = 0.538$ and connectivity $\beta = 0.258$.
RQ4: What is the relationship between digital leadership and PM performance?	Primarily positive through indirect/enabling organizational mechanisms; a universal direct effect is not supported.
RQ5: What is the relationship between employee digital competencies and PM performance?	Positive and statistically significant; Digital Fitness $\beta = 0.309$.
RQ6: What is the relationship between digital PM systems and PM performance?	Positive and statistically significant; Digital Tools $\beta = 0.218$, with additional support from connectivity and digitalized project-practice evidence.
RQ7: What is the relationship between data-driven decision-making and PM performance?	Positive and statistically significant; Analytical Capability $\beta = 0.163$, $p = 0.002$.
RQ8: Which dimension makes the strongest contribution?	No single dimension dominates universally. Digital Readiness and Connectivity are strongest in SEM evidence, while Digital Tools ranked highest in a separate multi-criteria study.

Source: Developed by the researcher based on the complete empirical analysis.

4.20 Overall Interpretation of the Main Research Hypothesis

The empirical evidence provides substantial support for the proposition that digital transformation contributes positively to project management performance.

Four of the five dimension-specific hypotheses receive direct statistical support. Digital infrastructure, employee digital competencies, digital tools/project systems, and analytical/data capability all display statistically significant positive relationships with project performance.

Digital leadership also receives support, but its influence appears to operate more strongly through organizational conditions and capability-building than through a universal direct relationship.

The evidence therefore indicates that the impact of digital transformation is best understood as a **sociotechnical and organizational capability effect**, rather than as a simple technology effect.

This interpretation is particularly appropriate for SABIC. The organization's transformation strategy combines enterprise systems, artificial intelligence, data, digital workforce development, governance, automation, connectivity, and organizational adoption. SABIC's transition from STAR system activation to value realization demonstrates a similar understanding that technological implementation must ultimately be converted into operational and organizational benefits.

The company's wider transformation agenda also reports approximately US\$623 million of recurring EBITDA impact in 2025 and explicitly identifies technology deployment, productivity improvement, cost

optimization, and mega-project capital discipline among its transformation mechanisms. However, this study maintains the analytical boundary that this financial result cannot be attributed solely to digital transformation.

Thus, the final interpretation of H1 is:

The available empirical and organizational evidence supports a significant positive impact of digital transformation on project management performance, but the magnitude and pathway of that impact differ according to the digital capability, organizational environment, and project context.

4.21 Chapter Conclusion

This chapter conducted the statistical analysis and discussed the research findings concerning the impact of digital transformation on project management performance.

The empirical evidence demonstrated satisfactory reliability and validity. The principal engineering dataset produced Cronbach's alpha values between 0.833 and 0.891 for the digital-capability and project-performance constructs, KMO = 0.843, significant Bartlett's test results, cumulative explained variance of 78.015%, acceptable factor loadings, and satisfactory confirmatory-factor-analysis fit. These results support the measurement quality of the principal quantitative evidence.

Descriptive analysis showed medium-to-high digital capability, with connectivity recording the highest mean of 3.373. Project management

performance recorded a moderately positive mean of 3.193, demonstrating that digital capability contributes to but does not independently guarantee project success.

Correlation analysis identified statistically significant positive relationships between all three digital-capability dimensions and project performance. Connectivity produced the strongest correlation at $r = 0.379$.

Structural-equation analysis further demonstrated significant positive direct effects from intelligent capability, connectivity, and analytical capability on project performance. Connectivity was again the strongest direct predictor in the engineering sample.

Additional project-management evidence demonstrated significant positive effects from Digital Readiness, Digital Fitness, and Digital Tools. Digital Readiness produced the largest standardized coefficient in that model.

The results supported H1a, H1c, H1d, and H1e. H1b was partially supported because digital leadership demonstrated strong indirect and enabling relationships but not a consistent direct effect across empirical studies.

Analysis of official SABIC evidence demonstrated strong organizational congruence with all five digital-transformation dimensions. The company's transformation includes integrated enterprise infrastructure, senior digital governance, workforce capability development, enterprise digital systems, advanced analytics, artificial intelligence, automation, and data-driven decision support.

The principal hypothesis was therefore supported with qualification. Digital transformation has a positive impact on project-management performance,

but the effect occurs through multiple interdependent technological, human, managerial, and analytical capabilities rather than through technology alone.

These findings provide the evidence base for Chapter Five, which presents the research limitations, evidence-based recommendations, contribution of the study, recommendations for future research, and final conclusion.

5. CHAPTER 5: RESEARCH LIMITATIONS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

This chapter presents the final interpretation of the research concerning the impact of digital transformation on project management performance at Saudi Basic Industries Corporation in Saudi Arabia. It summarizes the principal findings obtained from the empirical analysis, identifies the methodological and contextual limitations of the study, develops evidence-based recommendations, proposes directions for future research, and presents the overall conclusion.

The research examined digital transformation through five dimensions: digital infrastructure, digital leadership, employee digital competencies, digital project-management systems, and data-driven decision-making. Project management performance was evaluated through time performance, cost performance, quality performance, stakeholder satisfaction, and overall project success.

The analysis presented in Chapter Four demonstrated that the relationship between digital transformation and project management performance is predominantly positive. However, the results also showed that digital transformation should not be understood as a purely technological intervention. Its contribution to project performance depends on the interaction among technological infrastructure, organizational readiness, employee capabilities, leadership, information systems, analytics, governance, and effective organizational adoption.

5.2 Summary of Major Research Findings

The first major finding of the study is that digital transformation demonstrates a generally positive relationship with project management performance.

Quantitative empirical evidence showed statistically significant positive effects for digital infrastructure, employee digital competencies, digital tools and project systems, and analytical capability. These findings support the central argument that organizations possessing stronger digital capabilities are more likely to experience improved project-management outcomes.

The second major finding concerns **digital infrastructure**. Digital readiness, digital fitness, tools, and connectivity were consistently associated with improved project performance. Among the statistical evidence reviewed, digital readiness and connectivity emerged as particularly important factors.

This indicates that organizations should not interpret digital transformation merely as the purchase of new technologies. Technology creates value when the organization is prepared to integrate it with existing processes, employees possess the capability to use it, systems are interconnected, and information is accessible across project functions.

The third major finding concerns **employee digital competencies**. The empirical evidence demonstrated that digitally capable employees and project teams positively influence project success. Digital skills therefore represent an important organizational resource rather than a secondary support function.

The fourth major finding relates to **digital project-management systems and digital tools**. The evidence indicates that integrated digital tools improve access to information, collaboration, monitoring, control, communication, and project decision-making. Their effectiveness, however, depends on system integration, employee adoption, and the quality of the information available through the systems.

The fifth major finding concerns **data-driven decision-making**. Analytical capability demonstrated a statistically significant positive relationship with project performance. This indicates that organizations capable of converting project and operational data into useful information can make better-informed decisions and respond more effectively to project risks and deviations.

The sixth major finding concerns **digital leadership**. Unlike the other dimensions, the evidence did not consistently demonstrate a simple direct relationship between digital leadership and project performance. Instead,

leadership appeared to operate primarily through organizational mechanisms such as governance, culture, resource allocation, capability development, adoption, and organizational influence.

This finding is important because it suggests that effective digital leadership should not be measured solely by whether managers personally use technology. Its value is reflected in whether leaders create the organizational conditions required for digital transformation to succeed.

Finally, the SABIC case analysis demonstrated strong congruence between the digital capabilities identified in the empirical literature and the organization's documented transformation activities. SABIC's digital transformation includes integrated enterprise platforms, automation, data analytics, artificial intelligence, workforce capability development, digital governance, and enterprise-wide system modernization.

However, the study maintained a clear analytical distinction between **SABIC-specific organizational evidence** and **statistical evidence obtained from external empirical samples**.

5.2.1 Summary of Hypothesis Findings

Table 5.1

Final Summary of Hypothesis Results

Hypothesis	Relationship	Final Decision
H1	Digital Transformation → Project Management Performance	Supported with qualification
H1a	Digital Infrastructure → Project Management Performance	Supported
H1b	Digital Leadership → Project Management Performance	Partially Supported

H1c	Employee Digital Competencies → Project Management Performance	Supported
H1d	Digital Project-Management Systems → Project Management Performance	Supported
H1e	Data-Driven Decision-Making → Project Management Performance	Supported
H0	Digital transformation has no significant effect on project management performance	Not supported by the overall evidence

Source: Developed by the researcher based on the empirical analysis presented in Chapter Four.

The findings demonstrate that four of the five dimension-specific hypotheses received direct empirical support, while digital leadership received partial support because its effect appeared to operate principally through indirect organizational mechanisms.

5.3 Research Limitations

Although the study provides substantial evidence regarding digital transformation and project management performance, several limitations should be considered when interpreting the results.

5.3.1 Absence of a SABIC-Specific Respondent-Level Dataset

The principal limitation is the absence of publicly available respondent-level data collected exclusively from SABIC project managers and employees covering all five digital-transformation dimensions and all project-performance variables adopted in this research.

Consequently, the study uses official SABIC evidence to establish organizational context and combines it with empirical data from relevant project, engineering, and digitally enabled organizational environments.

This means that the statistical coefficients presented in Chapter Four should not be interpreted as direct estimates of effect sizes among SABIC employees.

Rather, the study establishes whether statistically supported mechanisms identified in relevant empirical environments are present and theoretically applicable within the SABIC context.

5.3.2 Use of Secondary Data

The research relies primarily on secondary data rather than a newly administered questionnaire.

Secondary data provide several advantages, including access to larger and professionally collected samples, transparent measurement models, and the ability to compare findings across different contexts.

However, the researcher has limited control over the original questionnaire design, sampling procedures, measurement scales, respondent selection, and data-collection process.

Consequently, the available evidence may not perfectly correspond with every operational definition used in the present research.

5.3.3 Differences Between Empirical Samples

The quantitative evidence originates from different countries, industries, and project environments.

Engineering enterprises, construction-related environments, maritime projects, technology-related organizations, and agile project settings may differ from SABIC's petrochemical and industrial context.

These differences affect the extent to which statistical results can be generalized directly.

For this reason, the study uses **analytical generalization and evidence triangulation** rather than claiming population-level statistical generalization to the entire SABIC workforce.

5.3.4 Construct Equivalence

Some empirical studies use constructs that closely approximate but do not perfectly duplicate the dimensions adopted in this research.

For example:

- digital readiness and connectivity are used as evidence relevant to digital infrastructure;
- digital fitness is used as evidence relevant to employee digital competencies;
- digital tools and digitalized project practices are used as evidence relevant to digital project-management systems;
- analytical capability and big-data competency are used as evidence relevant to data-driven decision-making.

Although these mappings are theoretically justified, they remain proxies rather than completely identical constructs.

This limitation has been addressed by identifying the mapping transparently rather than treating related concepts as exactly equivalent.

5.3.5 Cross-Sectional Nature of Quantitative Evidence

A significant proportion of the empirical evidence is cross-sectional.

Cross-sectional research can demonstrate associations between variables but provides more limited evidence concerning long-term causality.

Therefore, the statistically significant relationships identified in the study support the proposition that digital capabilities contribute positively to project-management performance, but they do not independently prove that digital transformation causes every observed performance improvement.

5.3.6 Limitations of Corporate Reporting

SABIC's Integrated Annual Reports constitute highly relevant primary organizational sources. However, corporate reports are produced primarily for organizational reporting and stakeholder communication rather than independent academic causal analysis.

Such reports may naturally place greater emphasis on strategic achievements, successful initiatives, and value creation.

Consequently, SABIC's organizational evidence has been interpreted alongside independent academic evidence rather than treated as sufficient proof of causal relationships.

5.3.7 Financial Attribution

The research identified broader financial benefits associated with SABIC's corporate transformation activities.

However, SABIC's wider Transformation Program includes cost-management, portfolio, capital, operational, organizational, and technology initiatives.

Therefore, broader financial improvements cannot legitimately be attributed solely to digital transformation.

The research deliberately avoided interpreting corporate transformation benefits as direct financial returns from digitalization alone.

5.3.8 Rapid Technological Change

Digital transformation develops rapidly.

Artificial intelligence, automation, analytics, enterprise systems, project-management technologies, cybersecurity, and data-management practices continue to evolve.

Consequently, the technologies and digital practices examined during the study may develop significantly in future years.

The findings should therefore be interpreted within the study's temporal context.

5.4 Research Recommendations

The recommendations are derived directly from the statistical findings, SABIC case analysis, theoretical framework, and identified limitations.

5.4.1 Strengthen Digital Readiness Before Expanding Technology Investment

The empirical analysis identified digital readiness as one of the strongest predictors of project-management success.

SABIC and comparable organizations should therefore assess organizational readiness systematically before implementing major digital technologies.

Readiness assessments should examine:

- process standardization;
- technological compatibility;
- workforce preparedness;
- data quality;
- cybersecurity capability;
- leadership commitment;
- system integration;
- organizational culture; and
- expected business and project value.

Technology implementation should proceed only when organizational and project environments are sufficiently prepared to absorb and utilize the technology effectively.

This approach can reduce the risk of acquiring sophisticated systems that remain underused or poorly integrated.

5.4.2 5.4.2 Continue Strengthening Enterprise Connectivity

Connectivity demonstrated the strongest direct effect among the digital-capability dimensions in one of the principal empirical models.

SABIC should therefore continue developing integrated digital environments capable of connecting project teams, functions, business units, operational assets, information systems, contractors, and decision-makers.

The implementation of integrated enterprise platforms should increasingly support:

- real-time project information;
- integrated cost and schedule data;
- resource information;
- procurement status;
- contractor performance;
- risk information;
- engineering data;
- document control; and
- executive dashboards.

The objective should be to reduce fragmented information environments and create reliable single sources of project information.

5.4.3 5.4.3 Strengthen Digital Project-Management Systems

The findings demonstrate that digital tools and digitalized project practices positively influence project-management success.

SABIC should therefore ensure that enterprise digital platforms are effectively integrated with project-management processes.

This may include stronger integration between:

- enterprise resource planning;
- project scheduling;
- cost management;
- procurement systems;
- document-management systems;
- engineering systems;
- risk-management systems;
- resource-management platforms; and
- performance dashboards.

Where feasible, project managers should have access to integrated project information without requiring extensive manual reconciliation among multiple systems.

5.4.4 Establish a Project Digital Maturity Framework

SABIC should consider establishing a formal **Project Digital Maturity Framework** to evaluate the digital capability of projects and project teams.

The framework could assess:

1. Digital Infrastructure
2. Project-System Integration
3. Data Quality and Availability
4. Project Analytics Capability
5. Digital Skills
6. Leadership and Governance
7. Automation
8. Stakeholder Digital Collaboration
9. Cybersecurity
10. Benefits Realization

Projects could be assessed at different maturity levels and provided with specific improvement plans.

This would allow management to compare digital maturity among projects and determine whether more digitally mature projects achieve better schedule, cost, quality, safety, stakeholder, and overall performance.

5.4.5 Continue Developing Employee Digital Competencies

The positive relationship between digital fitness and project-management success indicates that workforce capability must remain a strategic priority.

SABIC should continue investing in competency development for project managers, engineers, planners, controllers, analysts, and project support professionals.

Priority skills should include:

- data analytics;
- artificial intelligence literacy;
- digital project-management tools;
- dashboard interpretation;
- predictive analysis;
- automation;
- digital collaboration;
- data governance;
- cybersecurity awareness; and
- digital change management.

Training should be linked directly to project roles rather than provided only as general technology awareness.

For example, project planners may require advanced analytics and predictive-scheduling capability, while project managers may need stronger digital leadership and decision-support skills.

5.4.6 5.4.6 Develop Digital Leadership as an Enabling Capability

The study found that digital leadership may operate more strongly through organizational mechanisms than through a simple direct effect on project performance.

Leadership-development programs should therefore emphasize the ability to:

- establish a digital vision;
- allocate transformation resources;
- create governance structures;
- reduce resistance to change;
- encourage experimentation;
- support employee learning;
- integrate technology with project strategy;
- monitor digital adoption;
- promote collaboration; and
- measure benefits realization.

Digital leaders should be evaluated not only by technology implementation but by whether employees adopt the systems and whether measurable project benefits are ultimately realized.

5.4.7 Expand Data-Driven Project Decision-Making

The significant positive relationship between analytical capability and project performance demonstrates the value of data-driven decision-making.

SABIC should continue developing project analytics capable of providing early warning and predictive insights.

Potential applications include:

- schedule-delay prediction;
- cost-overflow forecasting;
- contractor-performance analysis;
- procurement-delay forecasting;
- resource optimization;
- project-risk prediction;
- quality-deviation detection;
- asset reliability analysis; and
- stakeholder-performance dashboards.

Where sufficient high-quality data exist, artificial intelligence and machine-learning models may complement traditional project-control methods.

However, automated recommendations should remain subject to appropriate managerial oversight, particularly where decisions involve high financial, operational, safety, or stakeholder consequences.

5.4.8 Improve Project Data Governance

Data-driven project management depends on reliable information.

SABIC should continue strengthening project-data governance by defining:

- data ownership;
- data-quality standards;
- master-data requirements;
- access privileges;
- project-data classification;
- cybersecurity controls;
- retention requirements;
- validation responsibilities; and
- accountability for inaccurate or incomplete data.

A sophisticated analytics platform cannot compensate for poor data quality.

Therefore, data governance should be treated as a fundamental component of project digitalization.

5.4.9 Integrate Digital Transformation with Project Governance

Digital transformation should be embedded directly into project-governance structures.

Major projects could include digital-transformation requirements within:

- project charters;
- project execution plans;
- governance frameworks;
- project-control procedures;
- risk registers;
- stakeholder-management plans;
- lessons-learned processes; and
- benefits-realization plans.

This would help ensure that digital capabilities are treated as part of project strategy rather than as separate information-technology initiatives.

5.4.10 Measure Digital Benefits at Project Level

One of the most important recommendations arising from the study is the need for stronger project-level evidence.

SABIC should develop a structured method for measuring the benefits created by digital tools on individual projects.

Potential indicators include:

Schedule Indicators

- schedule variance;
- milestone adherence;
- decision-response time;
- planning-cycle duration.

Cost Indicators

- cost variance;
- forecast accuracy;
- administrative cost reduction;
- rework cost.

Quality Indicators

- defects;
- rework;
- inspection effectiveness;
- design-error frequency.

Stakeholder Indicators

- stakeholder satisfaction;
- communication responsiveness;
- information availability;
- contractor collaboration.

Digital Indicators

- system adoption;
- utilization rate;
- automation rate;
- data completeness;
- analytics usage.

Collecting these data systematically would allow future research to calculate SABIC-specific statistical relationships between digital maturity and project performance.

5.4.11 Strengthen Benefits Realization After Digital Implementation

The SABIC case demonstrates a transition from technological implementation toward value realization.

This is strategically appropriate.

Digital-project initiatives should not be considered successful merely because a platform has been implemented technically.

Post-implementation reviews should assess:

- adoption;
- utilization;
- process improvement;
- productivity;

- project-performance improvement;
- employee satisfaction;
- stakeholder satisfaction;
- financial benefits;
- risk reduction; and
- strategic value.

Digital investments that fail to achieve expected benefits should be evaluated to identify whether the cause relates to technology, processes, skills, leadership, data, or organizational resistance.

5.4.12 Maintain Cybersecurity as a Project Requirement

Greater digital connectivity creates increased dependence upon technological infrastructure and organizational data.

Project digitalization should therefore incorporate cybersecurity from project initiation rather than treating it solely as a corporate information-technology function.

Major projects should evaluate cybersecurity risks relating to:

- access management;
- contractors;
- cloud platforms;
- operational technologies;
- Internet-connected devices;

- project documentation;
- intellectual property;
- data transfer; and
- artificial-intelligence systems.

This is particularly important for large industrial organizations in which digital project systems may connect with operational technology and critical infrastructure.

5.5 Recommendations for Project Managers

Based on the findings of the study, project managers operating in digitally transformed environments should:

1. integrate digital tools into the project execution strategy from project initiation;
2. ensure that team members possess appropriate digital competencies;
3. use reliable project data rather than relying solely on intuition;
4. monitor technology adoption as well as technology availability;
5. promote collaboration through integrated digital platforms;
6. ensure that dashboards provide actionable rather than excessive information;
7. incorporate digital risks into the project risk register;
8. continuously assess whether digital systems improve time, cost, quality, and stakeholder outcomes;

9. provide feedback to organizational digital-transformation teams regarding system usability and project needs; and
10. maintain an appropriate balance between automated decision support and professional managerial judgment.

5.6 Recommendations for Other Saudi Industrial Organizations

Although SABIC is the primary organizational case, several findings may be relevant to other Saudi industrial organizations.

Organizations should avoid beginning digital transformation primarily with technology procurement.

Instead, transformation should begin with:

business/project problem → readiness assessment → capability development → technology selection → process integration → adoption → performance measurement → continuous improvement.

Organizations should also recognize that digital transformation requires coordinated investment in infrastructure, employees, leadership, data, governance, and project systems.

Smaller organizations that cannot reproduce SABIC's technological scale may still improve project performance by focusing initially on integration, reliable project data, employee capability, and disciplined use of existing digital tools.

5.7 Recommendations for Future Research

Future researchers can build upon the present study in several ways.

5.7.1 Conduct a SABIC Employee Survey

The most important future research opportunity is to administer a structured questionnaire directly to SABIC employees involved in project management.

The questionnaire should measure all five digital-transformation dimensions and the five project-performance dimensions established in this study.

A sufficiently large sample could support:

- Cronbach's alpha;
- exploratory factor analysis;
- confirmatory factor analysis;
- correlation analysis;
- multiple regression;
- structural-equation modelling; and
- comparison among departments or project categories.

Such a study would enable SABIC-specific effect estimates.

5.7.2 Conduct Longitudinal Research

Future research should examine projects before, during, and after major digital implementations.

Longitudinal data would improve understanding of whether project performance changes over time and provide stronger evidence regarding causality.

5.7.3 Compare Digital and Less-Digital Projects

Researchers could compare projects with high digital maturity against projects using more traditional methods.

Differences in:

- schedule performance;
- cost performance;
- quality;
- risk;
- rework;
- stakeholder satisfaction; and
- decision speed

could provide stronger direct evidence of digital-transformation benefits.

5.7.4 Compare Different Saudi Industrial Organizations

Future research could compare SABIC with other major Saudi organizations operating in energy, utilities, construction, manufacturing, mining, transportation, or infrastructure.

Such comparative studies would help determine whether the relationships identified in this research are specific to one organization or common across the Saudi industrial environment.

5.7.5 Examine Artificial Intelligence as a Separate Variable

Artificial intelligence is increasingly important within project environments and could be examined separately rather than being included within broader digital-transformation constructs.

Future studies could investigate its effect on:

- project planning;
- forecasting;
- cost estimation;
- scheduling;
- risk management;
- quality;
- procurement;
- decision support; and
- project controls.

5.7.6 Investigate Mediators and Moderators

The mixed findings for digital leadership suggest that future studies should examine indirect mechanisms.

Potential mediators and moderators include:

- organizational culture;
- organizational readiness;
- employee engagement;
- change management;
- knowledge-sharing capability;
- organizational resilience;
- project complexity;
- leadership support;
- cybersecurity maturity; and
- organizational size.

Such models may explain why digital transformation generates stronger performance improvements in some project environments than others.

5.8 Research Contribution

The study contributes to project-management research in several ways.

First, it integrates digital-transformation literature with project-management performance rather than examining general organizational performance alone.

Second, it operationalizes digital transformation through five interconnected dimensions rather than treating digitalization as a single technological variable.

Third, it expands the dependent variable beyond traditional time, cost, and quality criteria by incorporating stakeholder satisfaction and overall project success.

Fourth, it applies the conceptual framework to the context of a major Saudi industrial organization.

Fifth, it combines organizational case evidence with independent empirical statistical evidence while clearly distinguishing between the two.

Finally, the study demonstrates the importance of interpreting digital transformation as a combination of **technology, people, leadership, systems, data, and organizational readiness**.

The findings therefore support a sociotechnical understanding of digital transformation in project management.

5.9 Conclusion

Digital transformation has become a fundamental feature of contemporary organizational and project environments. Digital technologies increasingly influence how projects are planned, executed, monitored, controlled, communicated, and evaluated. Nevertheless, technological investment alone does not guarantee successful project outcomes.

The purpose of this research was to examine the impact of digital transformation on project management performance at Saudi Basic Industries Corporation in Saudi Arabia.

Digital transformation was examined through digital infrastructure, digital leadership, employee digital competencies, digital project-management systems, and data-driven decision-making. Project management performance was evaluated through time, cost, quality, stakeholder satisfaction, and overall project success.

The empirical evidence demonstrated a predominantly positive relationship between digital transformation and project management performance.

Digital infrastructure received strong statistical support. Digital readiness and connectivity appeared particularly influential, demonstrating that organizations require both technological resources and the organizational capability to integrate them effectively.

Employee digital competencies also demonstrated a significant positive contribution. This confirms that human capability remains central to digital transformation. Organizations cannot obtain the full benefits of advanced technology if employees lack the knowledge, confidence, and skills required to apply it.

Digital project-management systems and digital tools similarly demonstrated positive effects on project success. Integrated technologies can strengthen planning, communication, information availability, project control, and decision-making.

Data-driven decision-making was also positively associated with project performance. Analytical capability allows project organizations to transform

increasing quantities of information into actionable insights, enabling more informed and timely managerial decisions.

Digital leadership produced a more complex result. Rather than consistently influencing project performance directly, leadership appears to operate mainly through organizational influence, capability-building, governance, culture, resource allocation, and transformation support. The finding suggests that leadership should be viewed as an enabling mechanism through which digital capabilities are translated into performance.

Within SABIC, the organizational evidence demonstrates substantial alignment with these findings. The company's transformation involves enterprise-system modernization, integrated digital platforms, automation, artificial intelligence, analytics, data governance, workforce digital capability, and senior transformation governance.

The research therefore concludes that digital transformation has a **positive impact on project management performance when digital technologies are supported by organizational readiness, capable employees, integrated systems, effective leadership, reliable data, and disciplined adoption.**

The central implication is that successful digital transformation is not achieved by technology alone.

It is achieved when technology becomes embedded within the organization's people, processes, decisions, project systems, and strategic objectives.

For SABIC and other project-oriented organizations, the greatest benefits are therefore likely to emerge from a coordinated digital-transformation strategy that simultaneously strengthens infrastructure, workforce capability,

leadership, project-system integration, data-driven decision-making, and project-level benefits measurement.

Such an approach can contribute to improved project efficiency, stronger stakeholder outcomes, greater organizational agility, and more sustainable realization of value from digital investment.

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These references provide a much stronger core than the mixed-quality citations that appeared in some early working drafts.

7. APPENDICES

Appendix A: Research Variables and Measurement Framework

This appendix presents the measurement framework used to operationalize the independent and dependent variables of the study. The framework connects the conceptual definitions developed in Chapters One and Two with the empirical indicators used in Chapters Three and Four.

Table A1

Research Variable Measurement Framework

Main Variable	Dimension	Operational Representation	Principal Supporting Evidence
Digital Transformation	Digital Infrastructure	Digital readiness, connectivity, technological infrastructure, integrated systems, digital tools, enterprise platforms	Khasawneh and Dweiri (2024, 2025); Wang et al. (2026)
Digital Transformation	Digital Leadership	Digital vision, senior-management support, governance, transformation sponsorship, organizational influence	Li et al. (2026); Dinarti et al. (2025); Saudi Basic Industries Corporation (2024, 2025)
Digital Transformation	Employee Digital Competencies	Digital fitness, technological competence, digital literacy, analytics capability, training, adaptability	Khasawneh and Dweiri (2025); Fu et al. (2023); Saudi Basic Industries Corporation (2024, 2025)

Digital Transformation	Digital Project-Management Systems	Digital tools, digitalized project practices, integrated project information, enterprise systems, automated workflows	Raymond and Bergeron (2008); Caniëls and Bakens (2012); Monteiro et al. (2025)
Digital Transformation	Data-Driven Decision-Making	Analytical capability, big-data competency, predictive information, dashboards, artificial intelligence, evidence-based decisions	Wang et al. (2026); Li et al. (2026); Saudi Basic Industries Corporation (2024, 2025)
Project Management Performance	Time Performance	Schedule achievement, milestone adherence, timely execution, decision-response time	Wang et al. (2026); Shenhar et al. (2001)
Project Management Performance	Cost Performance	Budget compliance, resource efficiency, cost control, forecast accuracy	Wang et al. (2026); Raymond and Bergeron (2008)
Project Management Performance	Quality Performance	Achievement of specifications, functional requirements, reliability, reduction of defects and rework	Basu (2014); Wang et al. (2026)
Project Management Performance	Stakeholder Satisfaction	Owner satisfaction, participant satisfaction, collaboration, communication quality, willingness to cooperate again	Davis (2014); Wang et al. (2026)
Project Management Performance	Overall Project Success	Achievement of project objectives, organizational objectives, stakeholder	Shenhar et al. (2001); Albert et al. (2017)

		value, and intended project benefits	
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Source: Developed by the researcher based on the theoretical and empirical literature reviewed in Chapters Two and Three.

The framework demonstrates that digital transformation is not measured solely through technology acquisition. The study considers technological, human, managerial, information-system, and analytical capabilities. Project management performance is similarly treated as multidimensional and includes both traditional efficiency measures and broader stakeholder and project-success outcomes.

Appendix B: Empirical Evidence Register

This appendix presents the principal empirical evidence used in the statistical analysis and hypothesis evaluation. Each source retains its original sample, research context, and analytical methodology. The samples were not combined into a fictitious single dataset.

Table B1

Principal Empirical Evidence Used in the Research

Source	Sample Size	Research Setting	Analytical Method	Primary Use in the Present Study
Wang, Li, and Huo (2026)	422	Engineering enterprises	Descriptive statistics, reliability analysis, factor analysis, correlation analysis,	Principal quantitative evidence for digital capability and project management performance

			structural equation modelling	
Khasawneh and Dweiri (2025)	136	Experienced project-management professionals from different sectors and countries	Partial least squares structural equation modelling	Digital readiness, digital fitness, digital tools, and project-management success
Li, Tsai, and Yuen (2026)	253	Maritime professionals involved in project management	Covariance-based structural equation modelling	Digital leadership, technological competency, big-data competency, digitalized project practices, and project performance
Dinarti et al. (2025)	156	Agile project-management professionals	Partial least squares structural equation modelling	Direct and indirect effects of digital leadership
Oosthuizen and Grobbelaar (2024)	446 mass-survey respondents and 31 experts	Professionals across 51 countries and several industries	Quantitative survey and expert evidence	Triangulation of digital-transformation capabilities and organizational conditions
Saudi Basic Industries Corporation (2024)	Organizational documentary evidence	Global industrial organization	Documentary analysis	Organizational evidence concerning digital infrastructure,

				governance, employee capability, analytics, artificial intelligence, automation, and enterprise platforms
Saudi Basic Industries Corporation (2025)	Organizational documentary evidence	Global industrial organization	Documentary analysis	Evidence concerning enterprise-system implementation, intelligent automation, analytics, workforce development, adoption, and value realization

Source: Developed by the researcher from the empirical and organizational sources used in the study.

The evidence register demonstrates that the study is supported by several independent sources rather than a single empirical study. The quantitative sources represent different project environments and provide complementary evidence concerning the dimensions of digital transformation.

The Saudi Basic Industries Corporation evidence is treated separately because corporate documentary evidence establishes organizational context but does not constitute a respondent-level statistical sample.

Appendix C: Key Statistical Evidence

This appendix summarizes the principal statistical results used to evaluate the relationships between digital transformation and project management performance.

Table C1

Reliability Results of Principal Constructs

Construct	Cronbach's Alpha	Interpretation
Intelligent Capability	0.833	Good reliability
Connectivity	0.842	Good reliability
Analytical Capability	0.867	Good reliability
Project Management Performance	0.891	Good reliability
Digital Leadership	0.887	Good reliability
Organizational Influence	0.890	Good reliability
Agile Project Management Effectiveness	0.865	Good reliability

Source: Compiled by the researcher from Wang et al. (2026) and Dinarti et al. (2025).

All reported Cronbach's alpha values exceed the commonly accepted threshold of 0.70, indicating satisfactory internal consistency of the relevant measurement constructs.

Table C2

Principal Validity Results

Indicator	Reported Result	Interpretation
Kaiser–Meyer–Olkin Measure	0.843	Suitable for factor analysis
Bartlett's Test Chi-Square	5480.756	Statistically significant
Bartlett's Test Significance	$p < 0.001$	Factorability supported
Cumulative Variance Explained	78.015%	Strong explanatory coverage
Minimum Principal Factor Loading	Above 0.70	Acceptable

Project Performance Average Variance Extracted	0.629	Convergent validity supported
Project Performance Composite Reliability	0.894	Strong reliability

Source: Wang et al. (2026).

The validity evidence demonstrates that the principal constructs used in the quantitative analysis possess satisfactory measurement quality.

Table C3
Descriptive Statistics of Principal Digital Capability and Project Performance Variables

Variable	N	Mean	Standard Deviation
Intelligent Capability	422	3.349	0.901
Connectivity	422	3.373	0.957
Analytical Capability	422	3.192	1.003
Organizational Resilience	422	3.309	0.796
Project Management Performance	422	3.193	0.926

Source: Wang et al. (2026).

The results indicate medium-to-high levels of digital capability within the sampled engineering organizations. Connectivity recorded the highest mean, while analytical capability and project performance showed somewhat lower but still positive average scores.

Table C4
Correlation Between Digital Capabilities and Project Management Performance

Digital Capability	Correlation with Project Management Performance	Statistical Significance	Interpretation
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Intelligent Capability	0.307	$p < 0.01$	Positive, weak-to-moderate
Connectivity	0.379	$p < 0.01$	Positive, moderate
Analytical Capability	0.278	$p < 0.01$	Positive, weak-to-moderate
Organizational Resilience	0.306	$p < 0.01$	Positive, weak-to-moderate

Source: Wang et al. (2026).

All relevant digital-capability dimensions demonstrate statistically significant positive relationships with project management performance.

Table C5
Direct Effects on Project Management Performance

Relationship	Standardized Coefficient	p-value	Statistical Conclusion
Intelligent Capability → Project Management Performance	0.131	0.015	Positive and significant
Connectivity → Project Management Performance	0.258	< 0.001	Positive and significant
Analytical Capability → Project Management Performance	0.163	0.002	Positive and significant
Digital Readiness → Project Management Success	0.538	< 0.001	Positive and significant
Digital Fitness → Project Management Success	0.309	< 0.001	Positive and significant
Digital Tools → Project Management Success	0.218	< 0.001	Positive and significant

Source: Compiled by the researcher from Wang et al. (2026) and Khasawneh and Dweiri (2025).

Digital readiness represents the strongest standardized coefficient among the results shown in this table, while connectivity provides the strongest direct digital-capability effect within the Wang et al. model.

Table C6
Digital Leadership Statistical Evidence

Relationship	Standardized Coefficient	p-value	Statistical Conclusion
Digital Leadership → Agile Project Management Effectiveness	0.059	0.564	Not significant
Digital Leadership → Organizational Influence	0.662	< 0.001	Positive and significant
Organizational Influence → Agile Project Management Effectiveness	0.582	< 0.001	Positive and significant

Source: Dinarti et al. (2025).

These findings demonstrate that digital leadership does not necessarily influence project effectiveness directly. Instead, its influence may occur through organizational conditions, governance, culture, support, and capability development.

Appendix D: Hypothesis Decision Matrix

This appendix summarizes the final assessment of the research hypotheses following the statistical analysis and organizational case triangulation.

Table D1
Final Hypothesis Assessment

Hypothesis	Hypothesis Statement	Final Decision	Evidence Basis
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H1	Digital transformation has a statistically significant positive effect on project management performance	Supported with qualification	Overall convergence of significant positive effects across digital dimensions
H1a	Digital infrastructure has a statistically significant positive effect on project management performance	Supported	Significant effects from digital readiness, connectivity, and digital tools
H1b	Digital leadership has a statistically significant positive effect on project management performance	Partially Supported	Strong enabling and indirect effects, but a direct effect was not consistently significant
H1c	Employee digital competencies have a statistically significant positive effect on project management performance	Supported	Significant positive effect of digital fitness and supporting competency evidence
H1d	Digital project-management systems have a statistically significant positive effect on project management performance	Supported	Significant effects of digital tools, connectivity, and digitalized project practices
H1e	Data-driven decision-making has a statistically significant positive effect on project management performance	Supported	Significant effect of analytical capability and supporting big-data competency evidence
H0	Digital transformation does not have a statistically significant effect on project	Not supported by the overall evidence	Majority of relevant empirical relationships were positive and

	management performance		statistically significant
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Source: Developed by the researcher based on the statistical analysis presented in Chapter Four.

The principal hypothesis is classified as supported with qualification because the evidence comes from several independent empirical samples rather than one respondent-level sample composed entirely of Saudi Basic Industries Corporation employees.

Appendix E: Saudi Basic Industries Corporation Documentary Coding Framework

The organizational case analysis used a structured coding procedure to classify evidence from official Saudi Basic Industries Corporation reports according to the conceptual framework.

Table E1
Documentary Evidence Codes

Code	Research Dimension	Examples of Documentary Evidence
DI	Digital Infrastructure	Enterprise platforms, integrated enterprise resource planning systems, Internet-connected technologies, automation infrastructure, intelligent systems
DL	Digital Leadership	Executive governance, senior sponsorship, digital maturity monitoring, transformation objectives, value and adoption metrics
EDC	Employee Digital Competencies	Digital literacy, analytics training, data-science development, artificial-intelligence awareness, employee adoption capability

DPMS	Digital Project-Management Systems	Integrated workflows, standardized processes, digital platforms, enterprise information systems, automated information flows
DDDM	Data-Driven Decision-Making	Advanced analytics, artificial intelligence, predictive tools, integrated performance information, evidence-based decision support
TP	Time Performance	Scheduling improvements, reduced process cycle time, faster information and decision flows
CP	Cost Performance	Cost efficiency, productivity, resource optimization, capital discipline
QP	Quality Performance	Reliability improvement, process control, inspection capability, reduction in deviations and failures
SS	Stakeholder Satisfaction	Collaboration, stakeholder engagement, customer experience, information accessibility
OPS	Overall Project Success	Value realization, operational excellence, achievement of transformation objectives

Source: Developed by the researcher based on Saudi Basic Industries Corporation Integrated Annual Reports 2024 and 2025.

Table E2

Organizational Evidence by Digital Transformation Dimension

Research Dimension	Organizational Evidence Identified	Overall Assessment
Digital Infrastructure	Digital Operations Platform, enterprise resource planning modernization, integrated systems, automation, artificial intelligence, robotics, connected technologies	Strong evidence
Digital Leadership	Senior-level governance, executive oversight, digital maturity monitoring, portfolio prioritization, value and utilization measures	Strong evidence

Employee Digital Competencies	Data-science programs, digital literacy initiatives, analytics development, artificial-intelligence awareness, digital adoption	Strong evidence
Digital Project-Management Systems	Enterprise platforms connecting people, processes, data, standardized workflows and organizational functions	Strong evidence, although not presented publicly as one stand-alone project-management information system
Data-Driven Decision-Making	Advanced analytics, artificial-intelligence monitoring, predictive tools, data governance, integrated decision-support capabilities	Strong evidence

Source: Developed by the researcher from Saudi Basic Industries Corporation (2024, 2025).

The case analysis demonstrates that all five dimensions of the conceptual research model are materially represented within the organization's transformation activities.

Appendix F: Data Transparency and Academic Integrity Statement

The empirical evidence used in this research was obtained from identifiable and verifiable secondary sources. No survey responses, participant characteristics, statistical results, reliability values, correlations, regression coefficients, significance levels, or hypothesis outcomes were invented or simulated.

The research follows the principles below.

First, respondents from external empirical studies are described according to their original populations. No respondent from an external dataset or publication is represented as an employee of Saudi Basic Industries Corporation unless the original data source explicitly identifies that respondent as such.

Second, independent empirical samples are not merged into a fictitious combined sample. The samples used in this research differ in country, sector, respondent characteristics, measurement instruments, and analytical methodology. Each evidence set therefore remains independent.

Third, statistical values originally calculated by another researcher are clearly attributed to the original source. They are not described as newly calculated statistics unless respondent-level raw data were available and the calculation was actually performed as part of the present research.

Fourth, official Saudi Basic Industries Corporation reports are treated as organizational documentary evidence. Statements contained within corporate reports are not automatically interpreted as independent proof of causality.

Fifth, where an empirical construct is closely related to but not identical with one of the variables in the present conceptual model, the relationship is treated as a construct mapping or empirical proxy.

Examples include:

digital readiness and connectivity as evidence relevant to digital infrastructure;

digital fitness as evidence relevant to employee digital competencies;

digital tools and digitalized project practices as evidence relevant to digital project-management systems; and

analytical capability and big-data competency as evidence relevant to data-driven decision-making.

Sixth, contradictory or non-significant findings are retained in the analysis. The non-significant direct effect between digital leadership and agile project-management effectiveness, for example, was retained and resulted in the digital-leadership hypothesis being classified as partially supported rather than fully supported.

Finally, financial and organizational improvements reported by Saudi Basic Industries Corporation are interpreted according to their documented source and scope. The approximately United States dollar 623 million recurring earnings improvement reported for the wider 2025 corporate Transformation Program is not attributed exclusively to digital transformation because the broader program also incorporates cost, capital, portfolio, organizational, and operational initiatives.

These procedures are intended to preserve transparency, traceability, academic integrity, and appropriate interpretation of empirical evidence throughout the research.

Appendix G: Supporting Organizational Evidence

This appendix summarizes the principal documentary evidence supporting the Saudi Basic Industries Corporation case analysis.

G.1 Digital Infrastructure

Saudi Basic Industries Corporation reports continuing modernization of its enterprise digital infrastructure through the Saudi Basic Industries Corporation Transformation and Renovation program and the Digital Operations Platform.

The transformation includes an upgraded enterprise resource planning environment designed to connect people, processes, information, and business domains. The infrastructure supports standardization, automation, integrated information, advanced analytics, and intelligent applications.

The company's digital infrastructure also includes technologies associated with artificial intelligence, robotics, automation, predictive systems, digital asset monitoring, and connected operations.

Source: Saudi Basic Industries Corporation (2024, 2025).

G.2 Digital Leadership and Governance

Digital transformation within Saudi Basic Industries Corporation is supported through senior organizational governance.

The company reports that digital transformation is monitored through governing structures at senior organizational levels. Progress is assessed using measures including value creation, adoption and utilization of digital solutions, digital maturity, and transformation progress.

This evidence demonstrates that digitalization is treated as an organizational and strategic priority rather than solely as an information-technology responsibility.

Source: Saudi Basic Industries Corporation (2024, 2025).

G.3 Employee Digital Competencies

Saudi Basic Industries Corporation identifies employee digital capability as an important component of transformation.

The organization reports activities involving data-science training, digital literacy, analytics capability, artificial-intelligence awareness, employee adoption, and wider development of digital capabilities.

Such activities support the argument that technology produces greater organizational value when employees possess the knowledge and competencies required to use it effectively.

Source: Saudi Basic Industries Corporation (2024, 2025).

G.4 Integrated Digital Systems

The company's enterprise transformation seeks to integrate previously separated processes and organizational functions.

The upgraded enterprise environment connects people, processes, and data across business domains and supports standardized workflows, automation, analytics, and intelligent applications.

Although the corporate reporting does not describe the platform as a conventional stand-alone project-management information system, its integrated information and process functions provide important support for project planning, control, resource management, information sharing, and organizational decision-making.

Source: Saudi Basic Industries Corporation (2024, 2025).

G.5 Data-Driven Decision-Making

Saudi Basic Industries Corporation reports increasing use of data analytics, artificial intelligence, predictive monitoring, integrated data, and intelligent decision-support capabilities.

Examples include predictive asset-health monitoring, analytical tools for plant optimization, integrated performance information, and the use of artificial intelligence to improve operational decision-making.

These activities correspond closely with the data-driven decision-making dimension adopted in the research framework.

Source: Saudi Basic Industries Corporation (2024, 2025).

G.6 Transformation and Value Realization

The company's transformation developed from technology and platform implementation toward adoption, operational excellence, and value realization.

During 2025, the wider corporate Transformation Program generated approximately United States dollar 623 million in recurring earnings improvement and exceeded its annual target.

However, the broader Transformation Program includes cost excellence, capital discipline, portfolio optimization, operational transformation, organizational initiatives, and technological deployment.

For this reason, the present research does not interpret the entire reported financial benefit as an outcome of digital transformation alone.

Instead, it is used as contextual evidence demonstrating that the organization systematically monitors the financial and operational value associated with its wider transformation agenda.

Source: Saudi Basic Industries Corporation (2025).

Appendix H: Research Questions, Objectives, and Hypotheses Alignment

This appendix demonstrates the consistency between the research questions, objectives, and hypotheses.

Table H1

Research Alignment Matrix

Research Question	Corresponding Objective	Corresponding Hypothesis
RQ0: What is the impact of digital transformation on	RO0: Examine the impact of digital transformation on	H1

project management performance?	project management performance	
RQ1: What evidence demonstrates the level and nature of digital transformation at Saudi Basic Industries Corporation?	RO1: Assess the level and nature of digital transformation implementation	Descriptive/case analysis
RQ2: What evidence demonstrates project management performance in digitally enabled environments?	RO2: Evaluate project management performance using empirical evidence	Descriptive analysis
RQ3: What is the relationship between digital infrastructure and project management performance?	RO3: Determine the relationship between digital infrastructure and project management performance	H1a
RQ4: What is the relationship between digital leadership and project management performance?	RO4: Determine the relationship between digital leadership and project management performance	H1b
RQ5: What is the relationship between employee digital competencies and project management performance?	RO5: Determine the relationship between employee digital competencies and project management performance	H1c
RQ6: What is the relationship between digital project-management systems and project management performance?	RO6: Determine the relationship between digital project-management systems and project management performance	H1d
RQ7: What is the relationship between data-driven decision-making and project management performance?	RO7: Determine the relationship between data-driven decision-making and project management performance	H1e

RQ8: Which digital-transformation dimension demonstrates the strongest contribution to project management performance?	RO8: Identify the strongest contributing dimension and formulate recommendations	Comparative analysis of H1a–H1e
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Source: Developed by the researcher.

The alignment matrix demonstrates that each major analytical component of the project can be traced from the research problem through the research questions and objectives to the empirical analysis.

Appendix I: Statistical Decision Criteria

The statistical interpretation used throughout Chapter Four follows the criteria summarized below.

Table I1

Statistical Decision Criteria

Statistical Measure	Decision Criterion
Cronbach's Alpha	0.70 or higher considered acceptable
Composite Reliability	0.70 or higher considered acceptable
Average Variance Extracted	0.50 or higher considered acceptable
Statistical Significance	$p < 0.05$ considered statistically significant
Positive Standardized Coefficient	Indicates a positive relationship when statistically significant
Negative Standardized Coefficient	Indicates a negative relationship when statistically significant
$p \geq 0.05$	Insufficient statistical evidence for a significant relationship

Correlation Interpretation

Absolute Correlation Coefficient	Interpretation
0.00–0.19	Very weak
0.20–0.39	Weak
0.40–0.59	Moderate
0.60–0.79	Strong

0.80–1.00	Very strong
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Source: Statistical decision framework adopted for the present research.

Statistical significance is interpreted together with effect magnitude, theoretical relevance, study context, and measurement quality. A statistically significant relationship is not automatically interpreted as practically important or causal.

Appendix J: Summary of Final Research Evidence

Table J1

Overall Evidence Synthesis

Research Dimension	Quantitative Evidence	Saudi Basic Industries Corporation Evidence	Final Interpretation
Digital Infrastructure	Strong positive evidence	Strong organizational evidence	Important direct contributor
Digital Leadership	Mixed direct effect; strong indirect/enabling evidence	Strong governance evidence	Important enabling capability
Employee Digital Competencies	Significant positive evidence	Strong workforce-development evidence	Important direct contributor
Digital Project-Management Systems	Significant positive evidence	Strong integrated-system evidence	Important direct contributor
Data-Driven Decision-Making	Significant positive evidence	Strong analytics and artificial-intelligence evidence	Important direct contributor
Overall Digital Transformation	Predominantly positive across empirical studies	Enterprise-wide transformation documented	Positive relationship with project

			management performance, subject to contextual limitations
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Source: Developed by the researcher based on the complete findings of the study.

The combined evidence indicates that project-management performance is most effectively improved when digital transformation is treated as an integrated organizational capability. Technology, leadership, employee competence, systems, data, governance, and organizational readiness reinforce one another.

The evidence therefore supports the overall conclusion that digital transformation can improve project management performance, but successful outcomes depend on how effectively the different digital-transformation dimensions are integrated into project and organizational processes.