DEVELOPMENT OF AN INNOVATIVE DYNAMIC AND MULTIDIMENSIONAL LEADERSHIP MODEL IN PROJECT MANAGEMENT: A CASE STUDY OF THE ENGINEERING AND CONSTRUCTION INDUSTRY

Dissertation Manuscript

Submitted to Unicaf University in Zambia
in partial fulfillment of the requirements
for the degree of

Doctorate of Business Administration

By Yousef AlSoudani

May, 2025

Approval of the Thesis

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Abstract

DEVELOPMENT OF AN INNOVATIVE DYNAMIC AND MULTIDIMENSIONAL LEADERSHIP MODEL IN PROJECT MANAGEMENT:
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This study attempts to remedy the deficiencies in the extant monolithic and static leadership theories by exploring the dynamic (time-varying) and situational leadership behaviour of project managers for the specific case of the Architecture, Engineering, and Construction (AEC) industry. The researcher's philosophical stance is anchored in the constructivist interpretive paradigm; with the adoption of a hybrid inductive and deductive (abductive) research methods. Although the study seeks to unveil emerging leadership patterns through empirical evidence, a conceptual framework was formulated upfront to avoid conducting research in a theoretical vacuum. The framework is underpinned by a set of theories including transformational and transactional leadership, situational leadership, group dynamics, and complexity theory. The research is primarily qualitative; however, it also employed methodological triangulation using quantitative data to validate the trustworthiness of qualitative findings. Data was obtained from a global engineering firm with offices in different geographies. A heterogonous qualitative dataset was collected from 28 senior project managers via purposive criteria-based sampling using semi-structured interviews. The quantitative dataset was randomly collected from a sample of 300 project managers (with circa 43% response rate) using a self-administrated questionnaire survey. Thematic analysis and statistical methods were used to analyse qualitative and quantitative data, respectively. The application of systems thinking thereby treating leadership as a dynamic, process-based, and multidimensional social construct, supported by empirical evidence, enabled the synthesis of four substantive leadership models of practical relevance with recommendations for future research. Therefore, this study makes seminal contribution to literature and practice by assisting project leaders in successfully navigating leadership attitude and styles across the project lifecycle.

Keywords: Project Leadership, Dynamic, Situational, Multidimensional, Systems Thinking, Project Lifecycle

Declaration

I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where stated otherwise by reference or acknowledgment, the work presented is entirely my own.

AI Acknowledgement

Non-Use of AI

I acknowledge that I have not used any AI tools to create, proofread or produce any text or ideas related to any draft or final versions of the thesis.

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Acknowledgement

I would like to deeply thank my supervisor, Dr. Mary Mutete Mwanzia, who assisted me throughout the entire doctorate thesis journey. Her continuous motivation was an essential driver to achieve this milestone. I also extend my appreciation to the interview participants who were enthusiastic about the research subject. Special thanks go to the senior project directors, who facilitated the data collection exercise and helped in carrying out the pilot studies, for their dedication and timely engagement.

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List of Abbreviations

AEC	Architecture, Engineering, and Construction
ANN	Artificial Neural Networks
AR	Augmented Reality
BIM	Building Information Modelling
CAQDAS	Computer-Assisted Qualitative Data Analysis
CAS	Complex Adaptive Systems
CFA	Confirmatory Factor Analysis
CPM	Critical Path Method
ECS	Engineering Complexity Scale
EEFs	Enterprise Environmental Factors
EL	Entrepreneur Leader
ETC	Engineering, Technology, and Construction
GCC	Gulf Council Countries
HPWS	High Performance Working Systems
IC	Informed Consent
KM	Knowledge Management
LAP	Leader-As-Practice

LDQ	Leader Dimensions Questionnaire
LXM	Leader-Member Exchange
MDL	Machine Deep Learning
MLQ	Multifactor Leadership Questionnaire
MTS	Multi-Team System
OFs	Organisational Factors
OS	Organisational Settings
PBOs	Project-Based Organisations
PC	Project Complexity
PESTLE	Political, Environmental, Social, Technological, Legislative, and Economical
PG	Path-Goal
PSAQ	Project Success Assessment Questionnaire
PLS	Partial Least Squares
PM3	Project Management Maturity Model
PM	Project Manager
PMBoK	Project Management Body of Knowledge
PMC	Project Management Community

PMI	Project Management Institute
QDA	Qualitative Data Analysis
SAQ	Self-Administrated Questionnaire
SEM	Structural Equation Modeling
SMEs	Small and Medium Size Enterprises
TC&M	Team Characteristics and Merits
VDL	Vertical Dyad Link
WBS	Work Breakdown Structure

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CHAPTER 1: INTRODUCTION

Leadership is a complex social phenomenon that permeates nearly all aspects of human affairs at personal and corporate business levels. Since its inception in the 1920s, scholarly research has been eagerly endeavouring to unravel leadership behaviour by answering the ubiquitous question of what makes a successful leader (Northouse, 2016). Similarly, practitioners in the architecture, engineering, and construction (AEC) industry had begun an everlasting quest for understanding and exploiting leadership following the industrial revolution and the birth of classical management theories. AEC is considered as a project-based business that is complex and utterly susceptible to PESTEL factors. It involves a plethora of actors and variables involving, among others, stakeholders, public community, logistics, resources, supply chain, time and budget constraints. Specifically, the dependency of AEC on projects adds another layer of complexity since projects are temporary endeavours intended to realize a set of benefits whilst being constrained by time and budget (PMI, 2017). Although many projects might follow the same principles, each AEC project is still considered unique and project's variables, and lifecycle, widely vary in setup and complexity covering multidisciplinary engineering design, construction, demolition, among others (PMI, 2017).

Such uniqueness and complexity of AEC projects has been putting more pressure on the industry to recruit competent project managers with keen leadership skills to achieve more with less. The pursuit for competent project managers, or nowadays known as project leaders, has been accelerating to meet the industry needs. This pursuit was expectedly accompanied by a large flux of research to further explore and understand leadership thereby creating models, and practical tools, for the purpose of assisting project managers to successfully lead and deliver their projects. The volume of leadership research has tremendously grown since the beginning of the 21st century and the word “leadership”, whether used notionally or literally, became inextricable from the business and organisational life. Organisations in the public and private sectors have become captivated by the goal of unlocking the secrets of leadership to effectively and efficiently harness its benefits (Bass et al., 2003; Bennet, 2009; Bennis, 2002; Chin, 2015; Nicolaides & McCallum, 2013). For instance, leadership became synonymous with successful delivery of engineering and construction projects (Bass et al., 2003; Bennet, 2009; Bennis, 2002). Both academics and AEC practitioners have been addressing leadership as a primary quality of the competent project manager (Barber & Warn, 2005; Clarke, 2012a; Clarke, 2012b). Madsen (2015) in her award-winning book explains that leadership is a decisive trait of the 21st century project leader and asserts, like other scholars, the growing need for “more people who can navigate complexity” (p.2) by demonstrating strong leadership behaviour (Clarke, 2009). Undoubtedly, the rapidly changing global business dynamics, turbulent economies, and increased competition, among other factors, have been driving the demand for more competent project leaders who can effectively handle and adapt to the modern complex and dynamic business environment (Appelbaum et al., 2015; Chin, 2015; Nicolaides & McCallum, 2013; Yukl, 2010). Moreover, many organisations including AEC firms have been growing into global conglomerates through organic growth, mergers, and acquisitions of local and regional firms. Evidently, such global expansion put more emphasis on multiculture leadership, and the notion of culturally conscious leaders became popular (Carte et al., 2006).

Accordingly, the large volume of scholarly and professional research led to a wide range of fragmented and convoluted theories, concepts, and definitions that left large room for subjective interpretations. At the early stages of leadership theory development, theories were reductive and mostly leader-centric thus focused on the leader's traits and attitude. This narrow perspective was followed by a scholarly journey that evolved into a set of more promising theories that incorporates the leader's subordinates and business environment. Nevertheless, these more recent theories remained static and limited in scope at large, while often sacrificing complexity for the sake of feasible publishable research. Regarding the specific case of the AEC industry, the situation is even worse with evidently sparse studies and simplistic theoretical frameworks that are not commensurate with the notorious complexity of the AEC industry. It could also be argued that such research constraints have been preventing a more effective implementation of leadership theories in practical business and project management settings. This claim could be supported by the chronic underperformance issues witnessed in almost all AEC's fields and market sectors such as urban infrastructure, transportation, energy, and environment, among others.

As a result, scholarly research has recently been taking more visionary avenues by departing from leader-centric theories to behavioural and process-based theories, and models, that recognize dyadic relationships between the leader and followers. However, many of these models are still deemed as academic with limited practical application, especially in project delivery business settings. Accordingly, it could still be argued that the different leadership concepts, models, theories, and definitions remain controversial, fragmentated, and often vague despite the recent improvement in leadership research.

Broadly speaking, there is still no universally accepted definition or interpretation of leadership, and literature is overwhelmingly loaded with a multitude of definitions, lexicon, concepts, classifications, and theoretical models, among other numerous industry-specific concepts (Avolio & Gardner, 2005; Awan & Mahmood, 2010; Day et al., 2014; Harris, 2004). Evidently, the problematic and wide characterization of leadership has been impeding the full understanding and exploitation of its benefits thereby limiting the ability of project managers to cope with and variability and complexity of the business environments. Another root cause behind the inefficient methodological approaches to the implementation of project leadership is the segregation between leadership traits and behaviours. Therefore, such disjoints between the different leadership concepts and theories could be rectified through a reasonably all-encompassing multidimensional leadership approach that is specifically tailored for AEC project leadership.

Generally, leadership theories could be classified into three categories, namely: leader-centric, behavioural-oriented, and process-based . The leader-centric theories focus on the leader’s personality and human character (i.e. traits) whilst the behavioural theories deal with leadership attitude and styles (e.g. transactional vs. transformational). On the other hand, process-based theories are more complicated and encompass the leader-follower vertical and horizontal dyadic and reciprocal relationships thereby more effectively capturing the intricate interaction between the leader and followers in different environmental settings (Alvesson, 2017; Campbell, 2007; Checkland, 2014; Day et al., 2014; Schedlitzki & Edwards, 2014; Northouse, 2016).

Most importantly, the advent of modern organisational structure theories such as systems thinking and complex adaptive systems, underpinned by multi-directional human interaction, offers opportunities for exploring leadership as a dynamic, time-varying, and multidimensional concept. For instance, project delivery is customarily contingent to the time-varying dynamics established among the various human actors including the project manager, subordinates, and internal/external stakeholders (Cole, 2012; Lussier & Achua, 2010). Similarly, organisational complexity which could be deemed as multidimensional arguably plays a central role in leadership behaviour due to the interaction between the leader and the organisational settings whether structural or cultural (Lussier & Achua, 2010; PMI, 2017). In this respect, Bennis (2002) points out that a corporation should be perceived as an adaptive organismic structure embedded in a complex and rapidly varying external environment. Moreover, leadership can take place at any organisational hierarchical level such as business units, functional departments, and project teams. For example, a project manager can exhibit and change leadership styles to effectively lead teams, whereas a managing director might need to exhibit different styles of leadership to align with business objectives. Relatedly, Mullins (2010) asserts that human behaviour is the manifestation of three interlinked systems, namely: personality which is related to psychology, social system, and the cultural system. Therefore, it is sensible to infer that the examination of these three systems, in isolation of the organisational settings, would be dysfunctional and incomplete.

1.1 Statement of the Problem

Leadership remains a multifaceted and contested social phenomenon, with no universally agreed definition or unified theoretical framework. The literature is marked by epistemological fragmentation, conceptual overlap, narrow examinations of isolated leadership traits, and persistent shortcomings across the wide spectrum of theoretical formulations (Avolio & Gardner, 2005; Awan & Mahmood, 2010; Bansal et al., 2019; Berg & Karlsen, 2016; Clarke, 2009; Clarke, 2012b; Day et al., 2014; Harris, 2004; Krog & Govender, 2015). Existing research has traditionally clustered around three main categories: leader-centric trait theories, behavioural theories, and dyadic process-based frameworks (Alvesson, 2017; Campbell, 2007; Checkland, 2014; Day et al., 2014; Schedlitzki & Edwards, 2014; Northouse, 2016). While each of these strands has contributed valuable insights, collectively they present a fragmented and often static portrayal of leadership.

The consequences of this theoretical fragmentation are particularly evident in the Architecture, Engineering, and Construction (AEC) industry, where international projects continue to suffer from chronic performance issues such as schedule delays, budget overruns, and unrealized benefits (Barber & Warn, 2005; Clarke, 2009; Madsen, 2015). Despite advances in project management practices, industry reports show that the percentage of projects consistently achieving their intended goals has remained stagnant over recent years (PMI, 2015). These persistent challenges underscore the inadequacy of prevailing leadership models, which fail to capture the complexity of project environments where cultural diversity, situational contingencies, and evolving business dynamics are ever-present (Jacques et al., 2008).

Several gaps can be identified in the extant literature. First, existing models often neglect the inextricable interconnectedness among leadership traits, behaviours, and process-based dynamics, treating them instead as isolated constructs. Second, contemporary frameworks are predominantly static and linear, failing to reflect the time-varying, dyadic, situational, and multidimensional characteristics of leadership that are critical to project success (Mazzetto, 2019). Third, mainstream leadership studies have been slow to integrate complementary perspectives such as Complexity Theory (Bossink, 2004) and Systems Thinking (Cladwell, 2012; Reisman & Oral, 2005), which could more effectively account for the nonlinear and emergent nature of leadership in project settings. As a result, the theoretical discourse has remained detached from the practical realities of leading complex, multicultural, and dynamic project environments.

Thus, the central problem lies in the absence of a comprehensive, dynamic, and practically relevant leadership framework tailored to the demands of the AEC industry. Current theories fall short in explaining how leadership styles transition, coexist, or adapt across the various phases of the project lifecycle and in response to shifting organisational and environmental conditions. By excluding critical situational and temporal variables, existing models limit both scholarly understanding and managerial effectiveness. Consequently, this study seeks to address these deficiencies by formulating a holistic, multidimensional, and dynamic leadership model. The proposed model integrates theoretical rigor with practical relevance, enabling project leaders to better navigate complexity, optimise leadership behaviour in alignment with contextual demands, and ultimately improve project performance across diverse organisational and business landscapes.

1.2 Purpose of the Study, Research Aims, and Objectives

The research aims at formulating a dynamic, process-based, and multidimensional overarching leadership model that has an authentic practical relevance. Given that such model is supported by empirical evidence, with sound theoretical underpinnings, it would be useful to assist project managers, and engineering practitioners, on how to optimally navigate leadership behaviour, attitude, and styles. In contrast to the existing monolithic models, the overarching framework and its derived sub-models not only address specific circumstance but also provide robust means for navigating leadership situationally over the project's lifecycle. This potentially leads to tremendous benefits in project delivery because leaders become more equipped towards effective response to their business environments (Jacques et al., 2008). This undoubtedly enhances success rates and accomplishment of quality, budget, and time performance metrics and targets.

Essentially, the synthesised substantive models can be exploited as management tools to guide practicing engineers, and to complement other professional models. Therefore, it is imperative to explore and understand the mechanistic, situational, time-varying nature of leadership as a multidimensional construct by properly setting up specific, measurable, realistic, and feasible time bound objectives (i.e. smart objectives). Most importantly, the objectives shall be hierarchically aligned with the research purpose and questions. For instance, misalignment between the objectives and research questions could result in inconsistencies and incoherence in the overall research approach. As such, the aligned objectives not only pillars of a focused research approach but also constitute a roadmap for the execution of the research.

Further, the research approach and methods are designed to meet the objectives. In this respect, the research is qualitative and characterised by scope because it pursues a macroscopic perspective of project leadership as a social phenomenon (Mazzetto, 2018). Accordingly, the depth and breadth of the research objectives shall be reasonably proportional to the desired macroscopic level. It could therefore be argued that the study seeks to answer the “what”, “why”, and “how” associated with dynamic situational leadership. For instance, what leadership styles do project managers commonly assume during a specific phase over the project’s life cycle in response to internal and external business stimuli. And, why project managers chose to change their leadership styles; and how does such change dynamically take place over the project’s lifecycle (Northouse, 2016; Yukl, 2010).

In the context of AEC projects, the theoretical formulation presented in this study plausibly stipulates that leadership behaviour is dynamic, process-based, and multi-dimensional because it is contingent to internal and external enterprise environmental factors and project complexity (Mazzetto, 2018; PMI, 2017). As such, the study aims at critically avoiding the replication found in extant research methodologies (Schedlitzki & Edwards, 2014) which either have a narrow leader-centric approach (e.g. traits) or treat leadership as a static phenomenon in isolation of interaction with the internal and external influencing factors such as subordinates, group dynamics, organisational structure and constraints, external enterprise factors, among others (Jacques et al., 2008). Accordingly, the study novelly pursues to capture the coexistence of and temporal nature of leadership styles rather than assuming one-off style under static conditions. This variability injects more realism and practicability in understanding, devising, and implementing leadership models that can be exploited as management tools to improve performance (Müller & Turner, 2010).

In light of the above explanation, the research's objectives can be stated as follows:

I. Attempt to address the gaps and deficiencies found in the extant theoretical and professional literature on project leadership for the particular case of the AEC industry. Specifically, this objective aims at investigating the observed absence of dynamic and multidimensional theorical models.

II. Identify the dominant leadership styles exhibited by project leaders in response to stimuli and business environments (i.e. theoretical variables) based on empirical evidence obtained from qualitative and quantitative data.

III. Explore dynamic project leadership that is plausibly characterised by the temporal transition between leadership styles over a project's life cycle (i.e. based on the defined variables) and the coexistence of multiple leadership styles, particularly for large and complex projects.

IV. Pursue an explanation of the reasons behind a project manager's decision to change his/her leadership style, or to assume multiple styles simultaneously, then attempt to synthesize a dynamic and multidimensional leadership model that can be of practical benefit to project managers in the AEC industry.

A constructivist and interpretive philosophical stances (Allwood, 2012; Azcárate, 2012; Thornhill et al., 2009) are adopted in this research whereby a hybrid deductive and inductive (abductive) approach, primarily focused on a qualitative methodology (Lodico et al., 2006; Thornhill et al., 2009). The abductive approach employs quantitative data analysis and qualitative thematic analysis for in-depth exploration of leadership behaviour and patters (Attride-Stirling, 2001; Clarke, 2009; Thornhill et al., 2009). Accordingly, this research aspires to expand and innovatively improve the way practitioners think about leadership in engineering and construction project management.

The inductive research began by constructing a specific theoretical framework which was subsequently utilised to empirically answer the posed research questions (Avgousti, 2013). Cullen and Leavy (2017) used a similar exploratory and inductive approach by interviewing project managers. Mixed methods would be used to verify and substantiate the correlation between the defined independent and dependent variables (Babones, 2016; Drouin et al., 2018).

Primary qualitative and quantitative data were collected through interviews and self-administrated questionaries (SAQs), respectively. All participants were selected from an international engineering firm that has +300 global offices in North America, Canada, Europe, United Kingdom, the Middle East in addition to offshore design centres in India, Philippines, and Romania. Based on the organisational structure definitions found in PMI (2017), the autonomy of project managers (leaders) varies between strong (project-based centralized control) and balanced (combination of project-based and functional structure). Non-probability purposive sampling was used to select all participants. The initial study sample comprised a total number of 30 interview participants and 300 SAQs respondents, chosen from different global offices. The size of the sample was qualitative sample was slightly reduced due to unavailability of some participants. The participants were selected based a set of criteria pertaining to seniority level, project management experience, track record, team size (subordinates), size and complexity of managed projects, among others. One-to-one semi-structured interviews were carried out and exploited open-ended semi-structured questions to solicit elaborate feedback from participants (Bansal et al., 2019). Further, probing was utilised in the event seeking further clarification and feedback from the respondents. Qualitative research offers in-depth understanding of social phenomena, particularly when the purpose of the study is to explain the phenomena (Bansal et al., 2019).

Although face-to-face interviews are preferred for building rapport with participants, the interviews will be conducted remotely via proprietary IT tools due to the prevailing pandemic restrictions and the associated travel challenges. Such tools offer online recording of interviews. Subsequently, the interviews will be transcribed and analysed to identify emerging patterns, themes, and to verify the proposed theoretical framework (Thornhill et al., 2009). It is foreseen that a standard interview will last for an average duration of 30 to 40 minutes, although interviews with senior project directors are expected to exceed the average duration.

The SAQ will be distributed via an internal email to a group of project leaders in the project management community based on a systematic filtering process. Muller and Turner (2010) used a questionnaire approach with 400 responses and conducted ANOVA analysis. An informed consent (IC) form will also be made available to the interview participants and SAQ respondents. The IC form will clearly describe the research aim and details so that the participants and respondent become fully informed about the purpose of the research and the details of the data collection and analysis exercises. Additionally, a pilot study was conducted to validate the SAQ and the interview questions. The pilot study also offers an opportunity to evaluate the time allocated for the interviews.

In summary, the research is predominantly qualitative in nature and is characterized by scope because it explores leadership at the macro level. Additionally, the research employs a hybrid deductive and inductive approach to formulate a multidimensional theoretical framework that explains real-world implementation of leadership (Thornhill et al., 2009).

Primary data will be collected from a case study international engineering firm based in the Netherlands. The firm has more than 27,000 employees located in global offices in Europe, United States, Middle East, Australia, Asia, and Philippines, among others. Offshore design offices reside in Philippines, India, and Romania. This provides a rich environment to account for and investigate the cultural effect on the dynamics of leadership. The firm structurally comprises business lines, with independent profit and loss accounts, and provides consultancy services for private and/or public sector clients in different market sectors such as infrastructure, power and energy, project management, and sustainable mobility, among others. Each business stream is further broken into various technical disciplines. For instance, the water business includes water management, intelligent water networks, conveyance, and treatment. The selected firm is deemed as a project-based organisation where autonomy of project managers might vary between strong and balanced organisational structures (PMI, 2014). In this respect, a project manager (PM), also referred to as a project lead, is appointed to either regional or global projects based on the internal classification of qualifications (e.g. experience, certification, education, etc). Consequently, a project leader might have team members from different national cultures and is also expected to manage virtual teams.

Over the past decade, the firm acquired designated engineering businesses to penetrate markets, and to increase its market share. Organisational decision-making conventionally passes through formalized procedures and could either be decentralized or centralized depending on antecedent conditions.

1.3 Nature and Significance of the Study

Leadership is arguably one of the most researched subjects in social science and professional fields such as project and engineering management. Project leaders often wander across the landscape of leadership literature to seek authentic and practical applications in the AEC industry. Training and coaching in this arena are not unified as well, and many project leaders ultimately end up confused regarding the optimum implementation of the myriads of leadership theories and models. In response to such desperate expeditions, this study attempts to formulate a holistic, dynamic, and multidimensional leadership model that has practical relevance to help project leaders and engineers in navigating leadership, and optimally leading complex projects to improve performance and outcomes.

Moreover, the AEC industry has not been doing so well in delivering large and complex projects to budget, timeline, and benefit realization. Strikingly, a large fraction of projects in various domains, such as infrastructure and buildings, are eventually delivered behind budget and schedule with the causes primarily attributed to leadership at all levels, staring from stakeholders, the sponsor, and moving down to project manager. For instance, a study by Flyvbjerg and Gardner (2023) included a colossal database of more than 16,000 projects in several fields, such as infrastructure, power, nuclear, airports, tunnels, dams, buildings, roads, information technology, among others. Their study revealed that around 91.5% of projects go over budget and behind schedule, with a stark 99.5% that go over budget, behind schedule, and with no or partial realisation of benefits. Predominantly, the lack of project leadership is claimed as the root cause of many of similar cited project failures. Such results are perplexing and alarming; hence signalling gaps in the existing research and emphasising on the need for more specific and conscientious research on project leadership.

Therefore, models with practical relevance, that are not overburdened with theoretical sophistication yet robust in their theoretical formulation, would be of great benefit to all stakeholders engaged in the project delivery process. Such models can be used as leadership tools to guide practicing engineers and project managers (i.e. recently the AEC industry started using the term project leader instead of project manager more frequently). Relatedly, the extant literature published by professional institutions and consultancies has a few simplistic leadership models, such as the four-quadrant model, that can be used but with limited scope. These models somehow resemble the treatment of a particle's motion in space as one dimensional and static; therefore, it could be argued that such models have limited useful applications, particularly for projects characterized by complex internal and external environments (e.g. global multi-national team, local and virtual teams, complex stakeholder environment).

Comparatively, the multi-dimensional model envisaged in this research stipulates situational factors and the dynamic (time-varying) nature of leadership attitude and behaviour, especially in business environments characterised by variability and complexity such as in the case of the AEC industry. The model formulated in this research employs such realization to capture the mechanism(s) and factors that directly influence, and ultimately drive, the leadership styles, attitude, and behaviour exhibited by project leaders over the project's life cycle. It could be argued that such level of analysis in the theoretical formulation is imperative to adequately navigate the complexities of leadership behaviour. Such approach will potentially lead to more reliable formulation and construction of practical leadership models supported by theory and empirical evidence.

1.4 Research Questions

The research questions are formulated based on the aims and objectives. In this respect, a starting point would naturally be the investigation of the serious gaps identified in literature since this is one of the primary concerns as previously described. The gaps will be examined under general leadership theory and for the specific case of the AEC industry as well to further contextually steer the research components in the right direction. A prudent identification of research gaps, for the AEC industry, will largely guide the research towards the formulation of relevant and practical models. Expectedly, the next question to ask would logically be related to the leadership styles that are commonly exhibited by project managers, especially those who lead large and complex projects. Understanding the dominant leadership styles is deemed as the initial condition of the problem, analogous to the boundary value problems in mathematical modelling. As such, starting with the dominant leadership styles plausibly contributes to a better understanding of dynamic nature of leadership style and it changes over time under the different influencing factors. Accordingly, the subsequent question should surely address the dynamic time-varying nature of leadership. The answer to this question is pivotal to the comprehension of the multi-dimensionality and the dynamic nature of leadership behaviour among project managers. Lastly, the answers to the previous questions, which would be obtained through the implemented research method, can be examined and synthesised in order to formulate the intended practical model. Most importantly, the reference to a practical model does not necessarily imply that the research will result in a single model or framework. In this respect, the singular reference merely aims to simply the narrative. As such, it is expected that an overarching model will be produced, and which could span multiple sub-models of specific nature based on the investigated leadership dimensions. Accordingly, four research questions have been stipulated as articulated below. The research questions are coherently and logically synchronised with the research objectives, conceptual framework, and reanchored in the research findings.

RQ-I: What distinctive leadership styles are predominantly exhibited by AEC project leaders over the project’s Lifecyle?

RQ-II: How do the external stimuli influence the dynamic leadership behaviour of AEC project managers? (i.e. external stimuli are the independent variables).

RQ-III: In what ways do project leaders adapt and evolve their leadership behaviour through transition between leadership styles or coexistence of multiple styles?

RQ-IV: How can a theoretically informed and empirically grounded model of dynamic and multidimensional project leadership be developed to guide effective leadership practice in the AEC industry?

The research questions were articulated to clarify the domain and context (i.e. AEC projects) while emphasizing the specific research scope. Moreover, each question is open-ended and encourages in-depth exploration, critical analysis, and discovery, avoiding binary or overly simplistic answers. The questions also follow thematic alignment as they interlink logically while progressively addressing leadership phenomenon and depicting theoretical synthesis. Additionally, the questions were phrased with academic precision, reflecting rigor and relevance. They emphasise the applicability of research outcomes, particularly in RQ-III, aligning with scholarly and industry-focused goals.

CHAPTER 2: LITERATURE REVIEW

Leadership theory witnessed a paradigm shift from the leader-centric approaches, that dominated the twentieth century, and which inspired thinking about the leader's personal qualities and traits, to contemporary perspectives that assert the phenomenological and multi-fold nature of leadership as an emergent complex social phenomenon (Bohl, 2019; McLaurin, 2006; Megheirkouni & Mejheirkouni, 2020). Scholars and professionals in the modern era of leadership universally conceive leadership as a controversial and complex social phenomenon (Turner & Baker, 2018). There is also consensus that the philosophical grounding of leadership is continuously under controversy and critique (Avolio & Gardner, 2005; Awan & Mahmood, 2010; Bohl, 2019; Day et al., 2014; Harris, 2004). The theoretical underpinnings of leadership span over a wide range of leader-centric and dyadic leader-follower theories (Day et al., 2014). In this respect, leadership theory has been evolving since its inception in the 1920s from the leader-centric concepts, which segregate between the leader and followers, towards more process-based theories that focus on the leader's behaviour and dyadic relationships between the leader and the followers or subordinates (Schedlitzki & Edwards, 2014; Northouse, 2016).

Despite the aforesaid evolution and improvement on leadership theory, we seldomly find scholarly accounts that consciously recognize the coexistence and temporal interaction among the leader, followers, and the business environment (Alvesson, 2017; Campbell, 2007; Checkland, 2014; Day et al., 2014; Schedlitzki & Edwards, 2014; Northouse, 2016). In the case of the AEC industry, the unique and increasingly complex nature of large projects (Boonyathikarn & Kuntonbutr, 2021; Barber

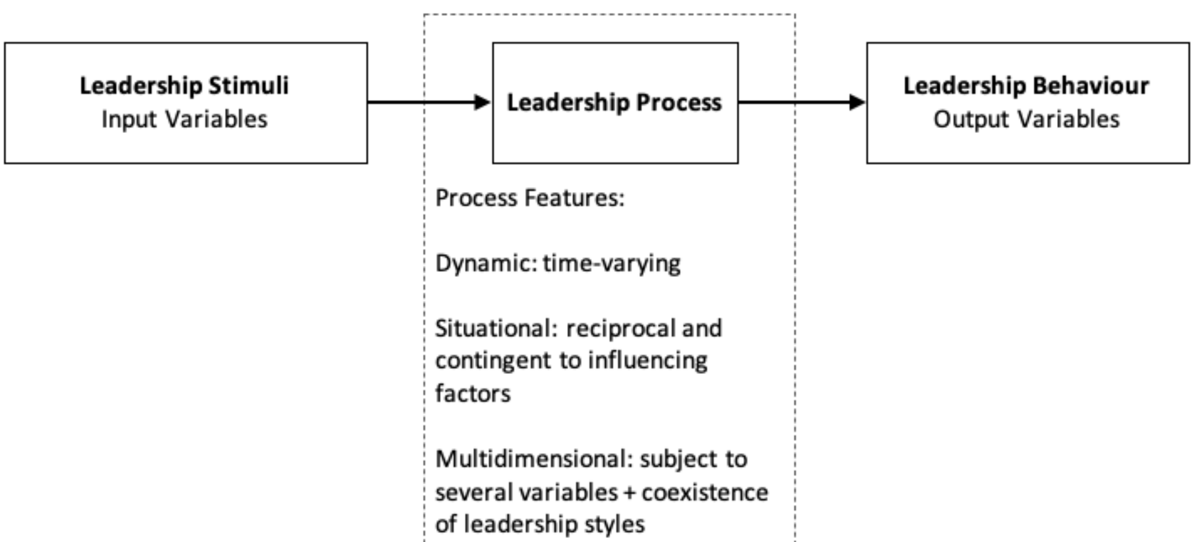
& Warn, 2005; Clarke, 2009; Madsen, 2015), involving many variables, numerous stakeholders (Lussier & Achua, 2010), and global teams (virtual and onsite) warrants a more holistic and bolder conceptual and theoretical treatment of leadership in order to arrive at a robust model of practical significance for project management professionals.

2.1 Theoretical Framework

In response to the problem statement given in the introduction, the current research employs a theoretical formulation that characterizes leadership as dynamic, multidimensional, and process-based social phenomenon (Mazzetto, 2019). This formulation comprises several inextricably interwoven constructs (Campbell, 2007) where the project leader is deemed to be in a continuous and reciprocal interaction (Yukl, 2010) with the followers, internal organisational settings, and external environmental factors (Alvesson, 2017; Clarke, 2012a). The leader also has relational links with other social actors (stakeholders) inside and outside the organisation.

Furthermore, the applied theoretical framework is founded on the plausible interconnectivity between several theories including transformational leadership, transactional leadership, group dynamics, complexity, systems thinking, and complex adaptive systems. As such, the theoretical framework aims at invoking conventional leadership thinking thereby contributing to the development of new middle-range theories (Grant & Osanloo, 2014). This perfectly correlates to the adopted inductive research methodology which chiefly depends on qualitative approaches and methods. Similarly, the choice of the theoretical framework integrates with the study rationale and serves the ontological and epistemological presumptions (Azcárate, 2012; Grant & Osanloo, 2014) used to explore project management leadership for the case of the AEC industry. The conceptual and theoretical frameworks that capture the aforesaid leadership multi-fold construct are described hereafter. To devise a useful and robust leadership tool of practical relevance to engineering project management professionals, particularly for large and complex projects, the adopted conceptual and theoretical frameworks connect the existing process-based leadership theories and further expand those theories by synthesizing multi-dimensionality and situational variability of the interlinked constructs. In other words, the theoretical formulation stipulates that leadership behaviour and styles are contingent to situational factors in the presence of coexisting interrelationships among other constructs. The conceptual framework is schematically illustrated in Figure 2.1 below. The operationalised framework that shows input and output variables is elaborated in Chapter 3 thereafter.

Figure 2.1
Conceptual theoretical framework



It is worth mentioning that formulating a conceptual (theoretical) framework at the outset is an accepted methodology that is widely implemented in scholarly qualitative research. This methodology which typically depends on inductive-deductive (abductive) reasoning, without necessarily introducing hypothesis, ensures that the research is carefully grounded in existing knowledge while allowing for flexibility, further insights, and discovery via emerging patterns and themes. In the context of AEC industry, where project leadership often involves dynamic challenges, this approach is beneficial for the development of nuanced models presented in Chapter 5. The upfront framework was conceived as an analytic preconception of the research problem because the research cannot be freed up from epistemological stances; and coding/thematic analysis cannot be performed in an epistemological vacuum (Braun & Clarke, 2006). For instance, Heifetz and Laurie (1997) developed a conceptual framework for adaptive leadership and tested it in engineering contexts. The authors expanded the framework by analysing how leaders manage adaptive challenges in complex, technical settings. Engineering project leaders used the framework to address stakeholder alignment in multi-disciplinary teams. Dainty et al. (2005) began with a conceptual model of competencies and refined it using qualitative data from in-depth interviews with construction managers. The framework was later expanded to include unforeseen competencies such as emotional intelligence and conflict resolution. Likewise, Highsmith and Cockburn (2001) developed an initial framework for agile leadership in software engineering and revised it based on focus groups and ethnographic observations in technical teams. This framework has influenced leadership models in other engineering domains, such as manufacturing and product development.

In comparison with extant literature, the formulation of the conceptual framework is uniquely and innovatively based on three fundamental epistemological pillars. Firstly, the conceptual framework critically incorporates project outcomes in contrast to the numerous renowned models, such as that by Bass (1985), which focused on the follower's perception of and satisfaction with the leadership effectiveness. For instance, a positive perception by subordinates of the manager's leadership styles does not necessarily translate into project success. Secondly, it employs and combines dyadic process-based and leader-centric leadership theories. Thirdly, leadership is treated as a dynamic phenomenon; therefore, situational leadership is considered legitimate and valid over the project's life cycle in contrast to static models which conceive leadership as a snapshot in time for a single leadership style or behaviour.

The conceptual framework comprises three main elements, namely: independent variables, leadership process, and dependent variables. The leadership process is the multidimensional function, or theoretical construct, that defines the relationships between the variables (i.e. independent and dependent). The theoretical underpinnings of the leadership process and the instruments used to operationalize the variables are described hereafter.

The conceptual framework is founded on a theoretical framework that exploits several interrelated theories. Firstly, the transformational leadership and transactional leadership models by Bass and Avolio (1994) and Bass et al. (2003) are employed to explore the occurrence and coexistence of leadership styles along a single Leadership Continuum (Northouse, 2016) rather than treating transformational and transactional leadership behaviours as mutually independent. Transformational leadership forms the extreme end of the Continuum where high motivation of followers (i.e. idealized influence, inspiration, intellectual stimulation, and individualized consideration) takes place whereas Laissez-Faire leadership, located at the other extremum, portrays a high degree of delegation with least motivation. Transactional leadership constitutes the middle ground between transformational and Laissez-Faire leadership whereby the leader exchanges value-laden promises with his or her followers. Transactional leadership encompasses contingent reward, active management-by-exception, and passive management-by-exemption. Furthermore, there are corroborated augmentation and moderation effects between transactional and transformational leadership (Cho et al., 2019). Therefore, the concept of a Continuum is well-suited in the research context. The Multifactor Leadership Questionnaire (MLQ), developed by Bass (1985), is used to map the identified leadership styles on the Leadership Continuum. Additionally, in contrast to extant research, the Transformational and Transactional Leadership Model is coupled with the Situational Leadership Model created by Hersey and Blanchard (1969) address the inhomogeneity among followers and to capture situational time variations of leadership styles as a response to the development level of followers (Northouse, 2016). The Situational Leadership Model defines four distinctive styles, namely: S1 (highly directive), S2 (highly directive and supportive), S3 (highly supportive), and S4 (low supportive and low directive or delegating). Secondly, the process-based dyadic connection between the PM and his/her subordinates is studied based on group dynamics (Cole, 2012), such as formation of in-groups and out-groups (Adeel et al., 2018; Chin, 2015), and the leader-member exchange (LMX) theory. In this respect, vertical and horizontal dyads are investigated. These dyads are also connected to the followers' inhomogeneity mentioned earlier

(Alvesson, 2017; Campbell, 2007; Checkland, 2014; Day et al., 2014; Schedlitzki & Edwards, 2014; Northouse, 2016). The concept of shared leadership is also exploited to connect some theoretical pieces pertaining to leadership of teams comprising subordinates and team members outside the leader's line management (Clarke, 2012b). Thirdly, the theory of Complex Adaptive Systems (CAS) is utilised to connect the dots between the variability in leadership styles against the internal and external environmental factors such as organisational settings and stakeholders (Sperry & Jetter, 2019) since the previously described theories are exclusive to the leader-follower construct without consideration for external circumstances (Cladwell 2012; Reisman & Oral, 2005). For instance, Bennis (2002) and Mullins (2010) assert that organisations resemble adaptive systems, and that social behaviour of managers, subordinates, and teams has intricate relationship with the organisational settings. Complexity can be classified under three categories, namely: human behaviour, system behaviour, and ambiguity. To be specific, this research maps those categories to the six complexity dimensions in Shi et al. (2020); namely, technical; social; financial; legal; and time.

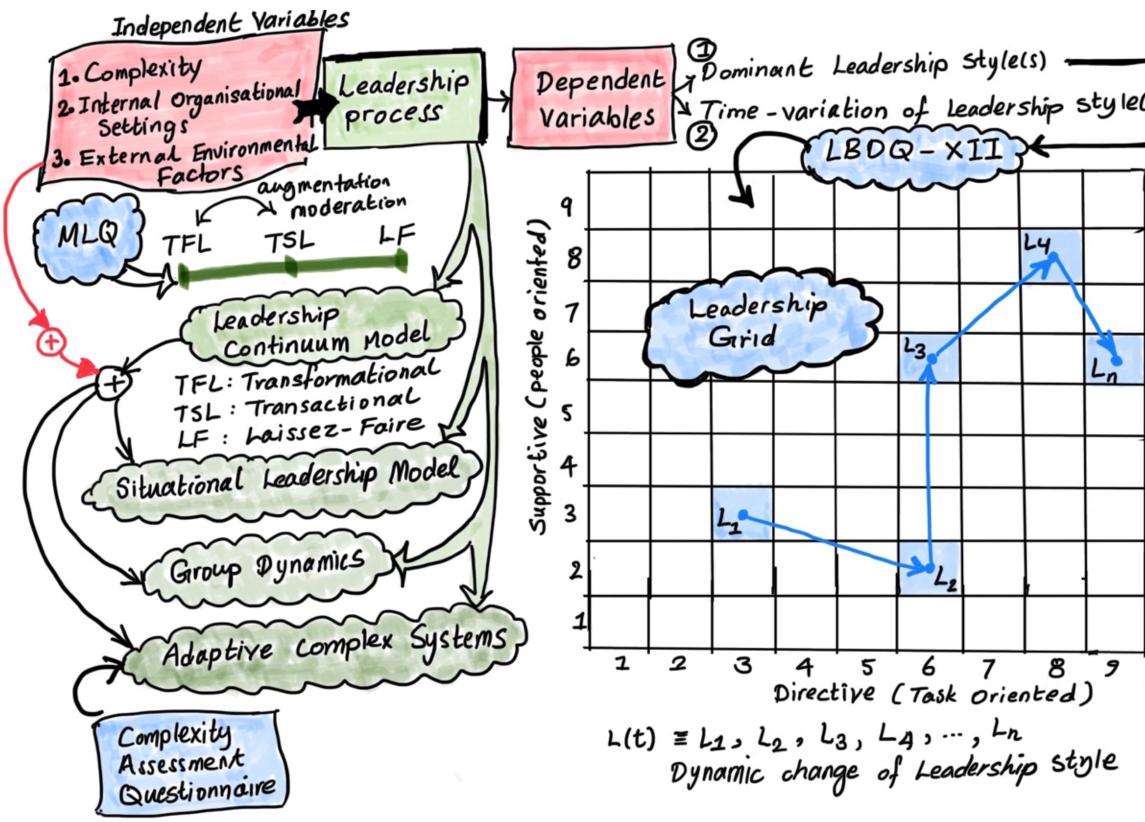
The innovative and coherent integration between the adopted leadership theories arguably serves the purpose of this ambitious research and offers a holistic examination and understanding of project leadership that surpasses that found in most of the obsolete studies that are dangerously limited in their scope and treatment of leadership phenomenon. In other words, the selected theories are not tackled independently in silos but rather congruently linked (Cho et al., 2019; Cullen & Leavy, 2017) as portrayed in the conceptual framework.

The three main independent variables are (a) project's complexity, (b) internal organisational settings, and (c) external environmental factors. Project complexity is broad concept that has links to technical difficulties (e.g. multidisciplinary), logistical challenges, geographic restrictions, team size, virtual teams, among others. For instance, design of the Apollo 11 space shuttle and construction of the Hoover Dam on Colorado River are considered complex engineering projects. The Complexity Assessment Questionnaire (PMI, 2014) which consists of 48 questions is used to measure the complexity of projects narrated in the qualitative interviews. Internal organisational settings include three components, namely: (a) project management structure (PMI, 2017) characterized by weak, balanced, or strong matrix, (b) project management competence measured by the Project Management Maturity Model (PM3) found in PMBok (PMI, 2017), and (c) team culture/character (e.g. skills, social culture, etc). External environmental factors, or alternatively known as enterprise environmental factors (EEFs), are multi-fold and cover stakeholder such as customers, government agencies, etc, and political, economic, social, technological, legislative, and environment factors (PESTLE). The dependent variables describe the dominant leadership styles exhibited by the project manager and the time-varying characteristics of such leadership styles. The Leadership Grid developed by Blake and Mouton (1985, as cited in Northouse, 2016), and the Leadership Behaviour Questionnaire (LBDQ-XII) devised by Stogdill (1963, as cited in Northouse, 2016), are used as instruments to identify, categorize, and cluster the dominant leadership styles demonstrated over the project's life cycle. The Leadership Grid (9-point scale) classifies a leadership style as a combination of task and people orientations. The robust and holistic integration between the adopted theories, defined variables, and selected measurement instruments is graphically illustrated in the rich picture given in Figure 2.2 below. Ahmed et al. (2021) mention that most of the project leadership studies use similar measurement instruments such as Leader Dimension Questionnaire (LDQ), Multifactor Leadership Questionnaire (MLQ), and Project Success Assessment Questionnaire (PSAQ).

In summary, a robust and reliable theoretical formulation stems from conceptualizing leadership as a complex multi-layered social phenomenon that is dynamically mediated and moderated by numerous interlinked situational and contextual factors pertaining to the followers, the organisation, and the external environmental factors. Leadership is considered as a dynamic process that has bi-directional interactions between the leader and followers, who reciprocally affect each other to effectively achieve collective leadership by the group. And, leadership process has multi-directional interactions among the leader-follower construct and other organisational and environmental factors. These mutual interactions, coupled by followers' characteristics and other situational factors, define the dominant leadership behaviours and styles exhibited by project leaders. The intriguing multi-dimensionality nature of leadership phenomenon has been driving scholars to synthesize a holistic systems approach in the quest of investigating leadership.

Figure 2.2

Integrated conceptual framework. Encompassing theoretical underpinnings (green), variables (red), and leadership measurement instruments (blue).



The Leadership Grid part of the graphic in Figure 2.2 is adapted from "*Leadership Theory and Practice*", by Northouse, 2016, p. 76.

2.2 Industry Description

Although the theorical framework, implemented in this research, can be reasonably tailored and generalized to many industries, it is essentially exclusive to the case of project leadership in the AEC industry, including its commonly known market sectors. The AEC industry is predominantly a project-based business that is characterized by technical and technological complexity, risks, uncertainty, among many other challenging factors that incorporate stakeholders, legislations, practice standards, physical and political constraints, and dynamic resource planning (Bossink, 2004; Barber & Warn, 2005; Liu et al., 2019). In contrast to routine business operations, which have a consistent and recurring nature, engineering projects are unique and temporary endeavours that usually have challenging budget and time constraints, and which are continuously subject to changes over their life cycles. Projects can be of mega or giga scale worth billions of dollars, and might hold strategic importance for organisations and countries, especially for major infrastructure, mobility, or energy projects that might involve transboundary stakeholders, governmental institutions, and funding agencies. The plethora of social actors and agents in such major projects intricately induces complexity, and further introduces layers of variability and multi-directional systemic interactions.

Additionally, major projects are often setup as standalone organisations with dedicated governance, structure, policies, protocols, and procedures. Sometimes such projects are geographically based in remote areas and have dedicated infrastructure services and facilities, so they could be claimed, in their own right, as standalone organisations. Furthermore, it is not uncommon to confront ambiguity and chaos in large complex projects during the project's different stages. AEC projects are not executed in isolation and are contingent to internal organisational factors and external business environment (Fairholm & Card, 2009). Relatedly, complexity is augmented in major public sector projects that are normally characterized by multiplicity of actors and contexts, political forces, social pressures, conflicting objectives and interests of internal and cross-boundary stakeholders, climate change and environmental challenges, economic stress, and regulatory constraints. Examples of such projects include large infrastructure schemes operated by local governments and funded by international agencies.

Likewise, globalization has been imposing more demand and pressure on AEC project managers (Müller & Turner, 2010) to lead multi-culture (Bansal et al., 2019) and international virtual teams (Carte et al., 2006). As Ahmed et al. (2020) point out, this puts more emphasis on leadership competency as a critical success factor for project delivery. Ahmed et al. (2020) stress that the AEC industry is facing a major challenge in relation to managing projects, and the fundamental issues were essentially found as relationship-based, especially for large and complex projects. Therefore, the role of the project leader is pivotal to the successful delivery of projects.

Accordingly, the traditional and rather simplistic construction of leadership phenomenon is no longer competent to explore the qualities and dynamic behaviour of successful project leaders in the twenty first century. Therefore, large AEC projects require a specific set of adaptive and transformational leadership practices, driven by systems thinking, to cope with complexity and to balance the multi-directional tensions between beneficiaries and stakeholders (Murphy et al., 2016).

2.3 Transformational and Transactional Leadership

Organisations have been undisputedly confronting an increase in business uncertainty and complexity over the past few decades due to globalization, turbulent economies, and geopolitical forces. This has been driving a ferociously competitive marketplace which demands more effective and flexible leadership in organisations to cope with these challenges. Organisations started realizing that innovative behaviour at the organisational level and employees' creative efforts are vital to remain competitive and out-run rivals. Accordingly, organisations have been seeking transformational changes to promote such creative efforts, hence, resorted to transformational leadership as a means to psychologically gain employee's trust, improve employee's self-efficacy, and enhance innovative thinking at all organisational levels (Azim et al., 2019).

As a response, organisations grew more complex structures and operations to adapt to the highly dynamic and multi-culture business environments (Appelbaum et al., 2015; Bass et al., 2003; Bennett, 2009; Nicolaides & McCallum, 2013). With the consequent high expectations of leadership as an essential ingredient for organisational success, the leadership arena started to witness more criticism of problematic unidirectional and leader-centric theories (Alvesson, 2017; Day et al., 2014; Schedlitzki & Edwards, 2014) and a paradigm shift in emphasizing process-based and situational leadership theories which define and treat leadership as a two-directional reciprocal process (Campbell, 2007; Checkland, 2014; Northouse, 2016). There is abundant scholarly research pertaining to transformational and transactional leadership. Most studies have taken a stepwise approach to examine transformational leadership without deeply diving into the "multi-construct and multi-level" composition of this phenomenon that encompasses cross-cultural, leader-follower duality, and other dimensions (Mahmood et al., 2018). For instance, contemporary leadership studies are more focused on Western cultures although their outcomes are universally applied (Wang et al., 2014). Moreover, extant research had given less attention to the coexistence of transformational and transactional leadership (Cho et al., 2019).

Transformational leadership focuses on intrinsic motivation and full engagement with followers to develop them and optimize their performance (Colman & Lion, 2021).

Undoubtedly, transformational leadership has emerged as a popular (Northouse, 2016) and effective style for improving organisational performance; however, it could be argued that the best approach to leadership might entail a combination of both leadership behaviours (Munir et al., 2017). A reasonable answer to such proposition requires considerable theoretical and empirical analysis. Broadly speaking, transformational leadership is concerned with motivating people, benevolently appealing to their special needs, raising morale and sense of belonging, and aligning personal and organisational values to exceed expectations (Adeel et al., 2018; Bass et al., 2003; Cho et al., 2019; Northouse, 2016; Yukl, 2010). Transformational changes in organisations require transformational leadership because it injects energy in followers and motivates groups to embrace changes (Aleksic, 2016). transformational leadership also positively contribute to emotional intelligence, task performance, organisational citizenship behaviour (Chen et al., 2018), and organisational learning (Vashdi et al., 2019). Further, transformational leadership could be seen as a multi-construct multi-fold social phenomenon that should be looked at from different organisational levels (Afsar & Umrani, 2020). The academic literature cites four distinct dimensions of transformational leadership behaviour, namely: idealized influence of followers, inspirational motivation, intellectual stimulation and solicitation of ideas, and individualized consideration of the followers' needs (Afsar & Umrani, 2020; Bass et al., 2003; Cho et al., 2019; Northouse, 2016).

Idealized influence is related to role model and ethical leaders who act consistently with vision and clear path, even under risks, and who usually earn the respect and confidence of their followers (Andi et al., 2021). In this case, the followers become attached to the leader in a charismatic way through positive perception of the leader's behaviour and attributes. Inspirational motivation takes place through encouragement and optimism to achieve goals and to reach the organisation's vision. Motivation can be intrinsic or extrinsic as explained hereinafter.

Intellectual simulation aims at driving independent thinking, creativity, and calculated risk endeavours, and at achieving a higher level of learning and growth (Mahmood et al., 2018). Normally, transformational leaders create a vision, and intellectually stimulate followers by challenging ideas, fostering innovation, and engaging followers in reciprocal communication processes (Cho et al., 2019). Moreover, they usually opt to encourage followers to reexamine assumptions and work, ask questions and provide feedback, to achieve higher outcomes while maintaining a sense of group direction. Comparatively, this approach could be ineffective when followers expect prescribed authoritative directions from their leader such as the case in collectivist cultures who tend to have an external locus of control, and who also value harmonious groups and "stability in the workplace" (Cho et al., 2019, p. 193).

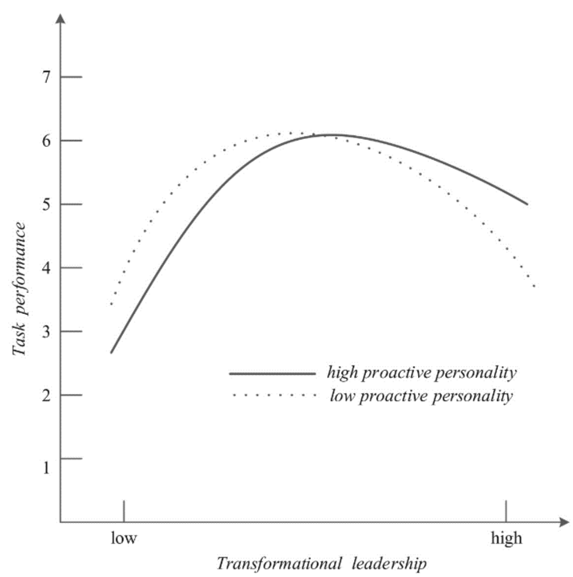
Individualized consideration, as the name implies, is focused on the distinct skills, qualities, motivational drivers, and performance of each individual in the group. As such, it can be inferred that a leader will explicitly create distinct relationships with individuals, also defined as vertical dyads in the Leader-Member Exchange theory (LMX), to effectively engage with followers according to their characteristics (Colman & Lion, 2021). As explained later in subsequent sections, this leadership behaviour can be perceived as situational where the followers' characteristics are input variables in the leadership process. Chan (2014) explains that individualized consideration is close to benevolent leader who uses strong interpersonal skills to build rapport with followers, and to ultimately influence their performance through inspiration, encouragement, and building cohesiveness among the team members. Performance further improves when leaders are self-aware of their own true values (Walumbwa et al., 2008). Likewise, Transformational changes require the implementation of transformational leadership which is a very close concept to shared leadership and different from transactional leadership (Aleksic, 2016). Transformational leaders can influence followers through their visionary ideas, intellectual simulation, functional expertise, emotional intelligence skills, supportive culture, and individualized or group mentoring. As explained throughout this literature review, the leader's influence is further affected by other mediating and moderating contextual variables. For instance, the leader's efforts to instigate and undertake transformational changes is affected by the follower's motivation to learn and support the leader's transformational initiatives (Afsar & Umrani, 2020).

Although the benefits of transformational leadership are abundantly cited, with wide consensus on the positive impacts of transformational leadership on individual and workplace performance, many empirical studies still revealed paradoxical double-edge sword results in terms of the favourable outcomes of transformational leadership (Chen at el., 2018). In this respect, transformational leadership might, under some moderating variables, produce negative effects on performance. Additionally, transformational leadership does not necessarily need to be dichotomous, therefore, its advantages and disadvantages vary nonlinearly and could coexist in the same system, but in different contexts and situational factors. For instance, the follower's proactive personality, as a moderating variable, curvilinearly influences task performance under low and high transformational leadership conditions (Chen et al., 2018). In other words, too much of a transformational leadership starts to create diminishing marginal returns on task performance in a nonlinear fashion. The performance of followers with high proactive personality might improve under high transformational leadership. Additionally, proactive personality is a manifestation of intrinsic motivation that makes followers search for resources and value even under negative leadership conditions. Motivation is dichotomized as either intrinsic or extrinsic (Colman & Lion, 2021). Autonomy and empowerment augment intrinsic motivation and positively relates to task performance. Intrinsic motivation comes under the second level of human behaviour. In this respect, behaviour occurs at three distinct levels. Level 1 is concerned with visible and measurable behaviour. Level 2 is related to consciousness and thought process. Level 3 is linked with personal values, beliefs, assumptions, and expectations. Leaders use a wide range of approaches to influence the three aforesaid levels (Colman & Lion, 2021). Conversely, followers with lower proactive personality are normally satisfied with the status quo and might be repelled under high transformational leadership when leaders attempt to stimulate and empower the followers. In such circumstances, the followers' perception of stress and overload, beyond their capabilities, hence leading to diminishing returns on task performance. Such curvilinear causal relationship is illustrated in figure 3.1.

This interesting empirical observation supports the theoretical conceptualization, adopted in this research, which looks at leadership from a system, situational, and context-specific perspectives. Likewise, such empirical results corroborate the vital effect of the followers' characteristics on the outcome of leadership, and also resonate with the possibility of coexistence whereby a leader might be in different reciprocal interaction with inner and outer groups.

Figure 2.3

*Curvilinear relationship between task performance and leadership with moderating effect of follower's proactive personality (Reprinted from "*Is transformational leadership always good for employee task performance? Examining curvilinear and moderated relationships", by Chen et al., 2018, *Frontiers of Business Research in China*, *12*(1), p. 20)



These interlinked concepts are considered in the theoretical formulation given in this research, and are further elaborated in the next sections. Transformational leadership is optimistically correlated with the ability to recover distressed and struggling complex projects, such as large IT projects (Lei et al., 2020). This is arguably due to the capacity of transformational leaders to effectively manage crisis situations (Santos et al., 2016), unite efforts, motivate teams, inspire followers to achieve recovery, regulate emotions (Sun et al., 2020), and create a collective vision to overcome obstacles and difficulties.

Comparatively, transactional leadership is simplistically founded on the concept of mutual constructive exchange of promises (Cho et al., 2019), or quid pro quo basis, and comprises three typologies known as: contingent reward, active management-by-exception, and avoidant or passive management-by-exception (Bennett, 2018; Bass et al., 2003; Northouse, 2016). Commonly, the leader promises a compensation which could take the form of monetary rewards and other institutional incentives, or alternatively disciplinary actions for unmet goals or target metrics, while the follower in turn promises to achieve the agreed objectives and goals defined by the leader (Ererdi & DURGUN, 2020). Therefore, the exchange process of materialized promises cannot be completed without the follower fulfilling his/her commitment of the agreement. Some scholars further identify that the exchange process can take the form of psychological transaction to satisfy a particular need in addition to the commonly known economical transaction which is based on material rewards and compensation (Andi et al., 2021; Bennett, 2018).

Management by exception is mainly about reflexive interaction. Active management by exception is about active monitoring to undertake correct actions and avoid errors (Colman & Lion, 2021). An active transactional leader sets the standards for compliance and the criteria for identifying ineffective performance. Over the course of performing the task, the leader continuously monitors the followers' performance and takes corrective measures accordingly. In contrast, passive management by exception is about remaining inactive until failures or errors occur. The leader will subsequently respond with corrective measures issued, either formally or informally, to the individual or group. This type of behaviour is commonplace in the engineering industry especially when dealing with personnel outside the organisation. For example, an engineer who is leading and supervising construction works might passively wait until a violation is committed and then issue corrective measures to the contractor.

A passive transactional leader waits for mistakes and underperformance to occur and subsequently takes necessary actions. In such event, if the leader is more oriented to avoiding actions, then he/she is exhibiting a laissez-faire leadership style (Yukl, 2010). Schedlitzki and Edwards (2014) believe that there is still some ambiguity and weaknesses in the conceptualization of dyadic relationships, collective group performance, and the nature of transactions in transactional leadership.

Contingent reward is still in the domain of management by exception but in this case, leaders use reward schemes in a hopeful attempt to control the followers' behaviour and performance, and to maintain the outcome of the leadership process (Colman & Lion, 2021).

In psychological perspective, management by exception, both active and passive, can be deemed as a "punishment-based" approach whilst contingent reward can be considered as a "reinforcement-based" approach, and both approaches are not believed to achieve optimal motivation (Colman & Lion, 2021, p.8) unless cross-fertilized with other leadership styles, especially transformational leadership. This claim can be argued as one of the logical reasons behind stressing situational and dynamic dimensions in leadership where leaders can simultaneously exhibit multiple leadership styles.

It could be argued that Western and non-Western scientific management approaches have some resemblance, to a certain extent, to active transactional leadership in their mechanistic and transactional-based treatment of human behaviour, and their acknowledgment of contingency and situation-driven management (Debicki, 2015; Mullins, 2010; Parker & Ritson, 2005). For instance, scientific management posits that higher financial remuneration positively contributes to commitment and productivity (Kitchin, 2010). In contrast to transactional leader, a transformational leader stretches the follower's motivation, loyalty, and commitment thereby driving the follower to voluntarily spend extra efforts; partly to fulfil his/her responsibility and to further create a positive perception about own performance (Bennett, 2009). Analogous to leadership versus management well-known mantra, transactional and transformational leadership behaviours could be conceived as doing things right against doing the right things, respectively (Bennett, 2009).

Cho et al. (2019) corroborated two mechanisms by which transactional leadership works in tandem with transformational leadership, namely: augmentation and moderating interaction. They assert that transformational leadership has a positive augmentation effect on the relationship between transactional leadership and group performance. Zhu et al. (2012) and Cho et al. (2019, p. 194) point out that such augmentation appears to be correlated to the "additional variance in psychological empowerment and organisational identification" of followers to a much greater extent beyond transactional leadership. However, this is still contingent to the cultural context. For instance, the impact of transactional leadership on organisational commitment is augmented by transformational leadership in egalitarianist and self-directed Western cultures. Moderating effects take place when transactional and transformational leadership are exhibited simultaneously within the same group and organisational setting. It is predicted that such combined behaviour either produces a synergy with positive compounded effects or debilitates the effectiveness of transformational leadership. nevertheless, some scholars still argue in favour of the positive complementary relationship where neither transactional nor transformational leadership entirely substitutes the other. Baker (2007) supports a follower-centric approach, and states that a leader should strike a balance between control and social relationships. Similarly, Holzmann and Mazzini (2020) assert that transformational and transactional leadership are the most preferred styles for creative and complex industries provided that project leaders strike a balance between both styles to guarantee discipline and innovation simultaneously. Moreover, there is a consensus that mixing of leadership styles is more suited for complexity and cultural diversity since it is more adaptive to situational variability. In such circumstances, leaders need to be dynamic and contingent to task nature, followers' characteristics, and external enterprise factors by either exhibiting multiple leadership styles simultaneously or transitioning between individual styles each at a time to cope with nonlinearity and unpredictability (Bennet & Bennet, 2014). Similarly, combining leadership styles is essential in wicked problem situations that are socially and politically demanding, and which require deeper trust by followers who engage in problem-solving processes (Head & Alford, 2015; Kreuter et al., 2004).

Evidently, transactional leadership is likely to influence continuance and normative organisational commitment, but transformational leadership will most likely be needed to elevate affective organisational commitment and citizenship behaviour (Dai et al., 2013; Clinebell et al., 2013; Cole et al., 2019). Relatedly, Clinebell et al. (2013) further elaborate that both transactional and transformational leadership have correlations with the various dimensions of the organisational commitment, however; transformational leadership is still substantiated as having a larger influence on affective organisational commitment. Dai et al. (2013) examined the hospitality industry and asserted that transformational leadership is strongly interrelated with fairness in decision-making, known as organisational distributive justice, while transactional leadership has a stronger connection with employee compensation/input ratio, or procedural justice. Obviously, it could be argued that there is a wide acknowledgment of transformational leaders who also effectively display transactional leadership contextually (Bass, 1985 in Zhu et al., 2012; Bass et al., 2003).

Most importantly, cultural underpinnings play a vital role in the effectiveness of transactional and transformational leadership behaviours and the combined implementation thereto (Brown et al., 2019). For example, Cho et al. (2019) found in their empirical study that transactional leadership was effective and resulted in more affective organisational commitment in Korea. In contrast, the authors concluded that transformational leadership was more effective among teams in US which is characterized by low power distance and individualized achievement. Accordingly, the results showed a preference in leadership styles when using “national context as a proxy for cultural differences” (Cho et al., 2019, p. 189). As such, transactional leadership is likely to be more effective in collectivist cultures dominated by emphasis on hierarchy, high uncertainty avoidance, and power distance, whilst transformational leadership is more intellectually stimulating and has potential for improving group and organisational performance in Western cultures, which are dominated by individualism, low power distance, and low uncertainty avoidance (Cho et al., 2019; Walumbwa et al., 2008). The reasoning that no single leadership style fits all cultures is widely supported by other scholars (Glick, 2002; Mandal, 2011). Interestingly, it could be observed that extant leadership studies tackled the relationship between leadership and national cultures; however, there are limited studies that brought organisational culture into the scene. The two types of cultures, which are utterly different, could be either competing or augmenting each other as mediating factors for leadership influence on organisational performance.

In summary, it could be argued that old scholarly accounts, such as Bass et al. (2003), have become less relevant in claiming the limited number of studies which predict the true contribution of transformational and transactional leadership to organisational performance. Such outdated views have perhaps become obsolete when taking into account the enormous developments in theoretical and empirical research on leadership over the past two decades. Yet, there is still a vast room for further exploration and analysis to deeply understand the mechanistic processes that govern the leader-follower-organisational interactive triangle in the context of transactional and transformational leadership behaviours.

Furthermore, although most of the studies mentioned in this essay suffer from common source bias (Bass et al., 2003) and lack of cross-cultural considerations, they still exemplify a consensus, and agreed wisdom, on the favourable complementary relationship between transformational and transactional leadership behaviours, and the positive managerial implications when leaders interchangeably adopt transactional and transformational leadership behaviours (Dai et al., 2013; Ebrahimi et al., 2017). Additionally, most of the literature assumes convergence between leaders and followers on the shared meaning and interpretation of leadership styles exhibited by the leader generally or in certain situations (Alvesson, 2017) which is often inaccurate, especially in ambiguous and complex situations. For example, a leader might delegate tasks while followers perceive this as a laissez-faire style. This debatable subject opens avenues for further navigation of the leadership arena by bringing a convergence-divergence construct into the conceptualization of leadership. Lastly, the conclusion that transformational and transactional leadership should not be considered as distinct behaviors, implemented in a piecemeal fashion, supports the formulation of the so called “leadership continuum” with transformational leadership at the highest relationship-focused end of the spectrum and laissez-faire leadership at the maximum transactional end; with transactional leadership situated in the centre of the continuum (Northouse, 2016, p. 166).

2.4 Situational Leadership

One of the pillars of the theoretical formulation in this research is the dependency of leadership style on the specific situation in hand. Many scholars have advocated the strong correlation between the leader’s behaviour and situational factors (Gardašević et al. 2021; McLaurin, 2006), both internal and external to the project, such as the complexity of the business enterprise, organisational settings and structure, and the characteristics of the followers, among many other factors. Some studies even extend this realization by conceptualizing that leadership is dynamic, and that a leader who has situational awareness usually adapts his/her leadership styles to those situational factors thereby exhibiting a dominant leadership style. Gardašević et al. (2021) stress that leaders are obliged to adapt their leadership behaviour and styles in accordance with the “specifics of the environment” and the “situation and problems they face” (p. 81).

Likewise, Aleksic (2016) highlights that leadership is heavily determined by the characteristics of the situation, and that the dominant leadership style should expectedly emerge based on the combined effect of the leader's personality traits, situation, and characteristics of the followers as well. Most classical and modern theories of leadership phenomena focus on personality traits of social, physical, and mental dimensions, and ignore the fact that followers are a critical constituent of the leadership process. Therefore, adjusting leadership styles to the characteristics and maturity of the followers, and actively engaging the followers in the leadership process can be deemed as a precondition for the effectiveness of the project's leadership landscape. Accordingly, it can be argued that such mutual two-way influence of the leader on followers, and the followers on the leader, forms a reciprocal process with inseparable variables, hence, leadership can be viewed as a function of aforementioned three variables, namely, the leader, followers, and situation. This also clearly implies that followers influence the selection of the dominant leadership styles as explained in the theoretical formulation given in the previous sections (Colman & Lion, 2021). Relatedly, extant situational leadership models, such as Hersey-Blanchard model, advocate that the two dimensions of leadership, exemplified by the orientation towards tasks and humans, are a manifestation of the leader's response to the characteristics of the followers. These dimensions high map to the followers' two maturity components, namely, business maturity and psychological maturity. Business maturity is related to followers' knowledge, competencies, and task-specific skills, and essentially reflects the followers' ability to perform without guidance. On the other hand, psychological maturity involves commitment, professionalism, confidence, responsivity, and motivation to take action under different situational conditions. Therefore, followers' maturity has a direct impact on the optimal leadership behaviour demonstrated by the leader (Aleksic, 2016). An interesting question to ask is how does maturity influence leadership behaviour. It could be argued that higher levels of maturity encourage more supportive and participatory leadership behaviour whereas low levels of maturity drive the leader to exhibit directive and controlling styles that focus on formalized procedures, policies, and standards.

In the case of transformational leadership, the follower's motivation and initiative behaviour is perceived as complex reciprocal cause-and-effect interaction between the follower, the leader, and situational variables that ultimately facilitates innovation or inhibits performance (Afsar & Umrani, 2020).

Aleksic (2016) puts more emphasis on situational moderating variables by drawing on the Path-Goal (PG) theory whereby the followers' personal traits and characteristics, such as locus of control, and the environmental factors, such as the formality and authority of the system, potentially determine the leadership style(s) that suits the specific situation. PG leadership focuses on the motivation of followers to improve their performance by creating a clear, obstacle-free, path for ultimately achieving target goals (Seltzer & Smither, 1995). In other words, PG is about helping followers to achieve goals. PG theory is complex, and its conceptualization builds on expectancy and contingency theories (Northouse, 2016; Yukl, 2010). Basically, PG is task-oriented and comprises four general dimensions, namely: leader behaviour or style, follower's characteristics, task features, and motivation. Task-oriented leadership styles focus on achieving goals and have less concerns about the relationship between leader and followers (Cuadrado et al., 2008). Unlike situational approaches, PG conceptualizes leadership as a function of the follower's characteristics and organisational settings whereby a leader contingently and temporally behaves in a manner which complements "what is missing in a work setting" (Northouse, 2016, p. 115). The leader behaviours depicted in PG theory are directive, supportive, participative, and achievement-oriented (Yukl, 2010).

It can be concluded that the careful evaluation of the situational factors helps the leader to vigilantly predict the effects of such situational factors on his/her leadership styles and the reciprocal effect of the dominant leadership styles on the group. For example, the leader may elect to follow a directive style if the task is complex and unstructured, and followers are less experienced; hence creating more sense of comfort and satisfaction among the followers, which leads to more organised collective efforts by the team to accomplish the task.

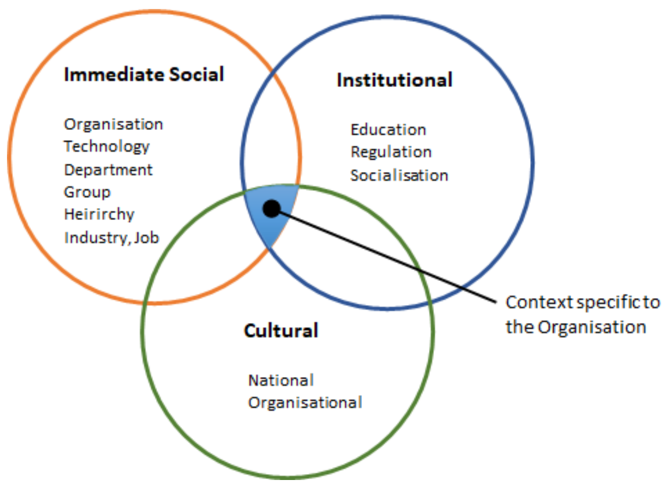
The previous discussion assumes that leadership is uniformly distributed across the group. This simplistic concept however ignores the fact that a leader might establish a specific relationship with each member of the group, especially in large heterogenous teams. This added layer of complexity gives rise to an array of vertical dyad links (VDL) based on the leader-member exchange (LMX) that should be considered separately for each follower. This form of LMX is often attributed to the formation of inner and outer groups. In such cases, the leader establishes a stronger relationship with the inner group due to egocentric attribution (Aleksic, 2016), while members of the outer group, who receive less attention, maintain a more formal relationship with the leader and usually work on routine tasks. In the case of inner and outer group formation, the leader examines and treats each team member separately through an internalized relationship. As relationships and group dynamics evolve, the leader might promote members from the outer group to the outer group. This dynamic nature of mutual interaction is one of the dynamic dimensions captured in the theoretical framework in this research. As such, the leader can manifest two different leadership styles simultaneously to lead to the inner and outer groups. Additionally, such leadership styles are not deemed as fixed in time, and can accordingly vary based on group dynamics and other influencing situational factors. The relationship can further develop with time based on team improvement and increased maturity. For instance, when members became highly skilled and responsible, the leader may promote more self-autonomy, empower the members, and allow them to make decisions independently. This sort of relationship where members become active rather than passive results in some form of shared leadership in which members are called "effective followers" and can reciprocally influence the leader.

Jepson (2009) undertook an empirical study on 12 organisations in chemical industries in UK and Germany, and highlighted the lack of understanding and attention given to the *context* dimension and its interaction with individuals and the process of leadership, in addition to the contradictory findings on the importance of immediate social context and general cultural context; with many researchers treating context as a "static phenomena" (p. 37). This study utilises the conceptual framework by Jepson (2009), illustrated in figure 2.4, on the dynamic interaction between the different levels of context and the leadership process to explore the leadership process in more depth. From an interpretivist epistemological view, Jepson (2009) found that leadership dynamically interacts with the different levels of context, with *department* as being the most influential social category.

However, the multi-directional dynamic interaction between the immediate social, institutional, and cultural contexts suggests the systems nature of the leadership process, and puts more emphasis on treating leadership and a complex, integrated and dynamic phenomena highly contingent to frames of reference and individualized interpretivism.

Figure 2.4

*Context-Leadership dynamic interaction framework (Adopted from "*Leadership context: the importance of departments", by Jepson, 2009, *Leadership & Organisation Development Journal*, 30(1), p.39)



Comparing this interdependent dynamic nature with findings by Bienefeld and Grote (2014), they show that successful leadership in dynamic multi-team systems (MTS) greatly depends on attainting goals within each team while concurrently aligning the goals of all teams in an effective cross-team collaboration.

Vaagaasar et al. (2020) investigated Norwegian organisations in the telecommunication and IT consultancy industries and emphasised that project management leadership is contingent to context and situations related to the workplace and project environment. This situational contingency substantially affects decision-making and ultimately differentiates between the exhibited leadership styles. As the authors explain, situational contingency is a function of many variables including leader's dynamic character, face-to-face versus virtual interaction, organisational structure, communication channels, and followers' attitudes and characteristics such as competencies, specialized skills, national culture, values, beliefs, and project management maturity.

Podgórska and Pichlak (2019) studied project type as a situational moderating variable that influences project performance. They categorized project types based on strategic importance and complexity. Strategic importance of projects relates to their scale, number of involved stakeholders, size of administrative and technical efforts, among other features. On the other hand, complexity pertains to risks and uncertainty and could impact budgets and schedule. As discussed in the next sections, the project's complexity profile is multi-dimensional and depends on technical sophistication, number of staff involved in the project from all parties (contractors, consultants, client, public institutions, etc), size of operations, national cultures, technological advancement, among other numerous factors.

Another important, and mostly overlooked, dimension of situational influence is the duality of leadership and followership for project managers. In large engineering and construction organisations, project managers both lead projects and followers, and are themselves subordinates (followers) of senior managers or directors (Li et al., 2019). For instance, the project manager could have two reporting channels to a functional manager and a PMO manager as described in Section 6. Consequently, it could be inferred that there exists an additional leader-follower link in the leadership process that propagates through the leadership chain and ultimately affect followers at the lower hierarchy level.

Such conceptualization is of paramount importance in transformational leadership where emotionally intelligent managers in higher organisational hierarchy levels create vision for project leaders in the same department, or in other business units, and their values and positive impact cascade downwards throughout the organisational chart (Li et al., 2019). This is common in the construction industry where a projects or operations director, for instance, meets and inspires project managers and technical teams to assist in problem-solving through intellectual stimulation, and to drive performance by motivating the project managers and their staff especially during difficult times. However, relationship between the project manager and his or her supervisor is likely to be different than that established between the project manager and his or her subordinates (Li et al., 2019). These relationships are also contingent to the structure and characteristics of the organisation, and to the way transformational and transactional leadership behaviours are manifested at the different organisational hierarchies. Regarding situational impact, the aforementioned shared leadership creates a new dimension of situational impact as follows. In a similar

In summary, leadership is a process-based function of a whole and not of distinct isolated human personalities, whether those personalities pertain to the leader or followers. As such, variable inputs to the leadership function are not exclusive to the leader's and follower's characteristics but rather covers a wider range of trait, behavioural, context, and situational factors which are in continuous interplay with social actors on daily basis. The complex interaction of these variables (also referred to as state variables) coupled with the mediation effects by the organisational settings and environmental factors, produce a time-varying array of dominant leadership styles which each leadership style being a best fit for a specific set of state variables. Simply explained, the most effective leadership style when leading passive, stubborn, and change-resistant followers in a time of organisational crisis is certainly different from a leadership style under stable organisational circumstances and clear scope of work where followers expect direct instructions guidance. The former requires more transformational leadership behaviour; whereas the latter can thrive in an authoritarian leadership style especially when organisational and national cultures are factored in, among other relational and task behaviours that are governed by group dynamics.

2.5 Process-based Leadership and Group Dynamics

Aleksic (2016) refers to leadership as a multi-dimensional process that shall not merely be cantered about the leader as a figure, but which shall also look at the mutual reciprocal interaction and exchange between the leader and the group, whether inner or outer. Theoretically speaking, the reciprocal effects of the leadership process could lead to the realization of the leader’s behaviour as both a dependent and independent variable. This bi-directional interaction (Colman & Lion, 2021) depends on how the followers perceive the qualities, styles, and behaviour of the leader whereas such perception is also dependent on the cognitive capacities of the followers. Gardašević et al. (2021) define leadership as a process and mechanism that allows leaders to act on followers in a specific manner. Guo et al. (2021) express the relationship and interaction between the leader and subordinates as a complex dynamic process that is undergoing constant change based on team heterogeneity, cognitive characteristics of the social actors, emotional dimensions, among others.

For example, if the followers have implicit presumptions about how a leader should behave in certain situations, they are consequently prone to attribute leadership skills to a person who demonstrates aspects of such a specific behaviour, notwithstanding whether this person possesses such leadership skills or not. Equivalently speaking, if the behaviour of a project manager has led to positive effects, the group will attribute the skills and abilities of a leader to that project manager whenever the positive effects take place, regardless of whether such effects are truly the result of the project manager's leadership behaviour or not.

There is another attribution process associated with leadership known as internalization where the value system of the followers is linked to the organisational values. Another type of attribution process occurs through the interaction between the individuals in the team, which is referred to as social contamination (Aleksic, 2016). Clearly, there is no direct interaction, of influence, of the leader on the followers through the social contamination process, whereas internal interactions are based on the spontaneous exchange of reactions and emotions among the followers.

Leadership theories, concepts, and practical applications have been recently evolving to cope with the sophisticated and intricate organisational dynamics in today's turbulent and aggressively competitive marketplace. Evidently, the remarkable attention that leadership, as a social construct, has been receiving by scholars and practitioners is chiefly attributed to its undisputed importance in improving team performance and contribution to organisational success (Bemowski, 1996; Carte et al., 2006; Chin, 2015; Yukl, 2010). Leaders and followers, or subordinates, do not work in isolation. They are both undergoing a continuous and complex interaction process bounded by some type of formalized settings or organisational structure. Borrowing from the *systems* concept, both leaders and followers plausibly constitute parts of an integrated system subject to enterprise environmental factors; therefore, the behaviours and actions of one part have feedback effects on the other and vice versa. Similarly, followers can perform independently or be an extricable part of an organised body, known as a group, with members cooperatively pursuing common purpose and goals. A group could be loosely defined as an organised collection of people but with a lesser degree of personal identification, and sense of belonging, than that assumed by teams; however, the terms groups and teams will be used interchangeably in this essay for the sake of simplicity. Cole (2012) succinctly defines group dynamics as the governing forces, interrelationships, and transactions between group members that ultimately influence group's performance. Moreover, Cole (2012) points out that the body of knowledge pertaining to group dynamics emerges from various theoretical backgrounds including, but not limited to, behavioural, cognitive behaviour, psychoanalytic, and systems theory as pointed out earlier. Expectedly, the diversity of the group members' traits, personalities, values, attitudes, abilities, competencies, and behaviours make group dynamics as complex and nonlinear. Further, I argue that such complexity has recently been compounded by globalization, cultural variations in the workplace, and the increasing demands of highly competitive markets, in addition to the flourishing of new modes of working such as virtual or remote teams. As such, the leader's role is profoundly centred around overcoming the challenges related to group diversity and relationship management to positively influence group dynamics, eliminate tensions, and achieve effective outcome. The leader shall essentially maintain such effectiveness throughout the different stages described in Tuckman's model starting from team forming and ending up in adjourning.

Leadership styles primarily affect team building, decision-making, motivation, innovation, creativity, and conflict management; and directly correlates to how a leader accomplishes balance between people's demands and needs against the collective targets and goals.

Creativity is a vital determinant of organisational survival in the contemporary turbulent and highly competitive marketplace. The effects of empowering leadership on creativity are controversial. While structural or psychological empowerment, and granting autonomy, can enhance the collective learning behaviour and innovation of the group, some scholars believe to the contrary that it might hinder the exchange of creative ideas among members (Adeel et al., 2018). Additionally, the motivation of a group largely depends on the confidence in the project leader, and this consequently facilitates more interaction among the project's team members (Cole, 2012).

Furthermore, when group members come from different functions or departments in the organisation, forming what is known as a cross-functional team, the group decision-making dynamics become strongly linked to leadership styles and behaviour which might either amplify or hamper collective performance (Chin, 2015). For instance, empowerment, participative, and democratic leadership styles facilitate interaction between group members, and reduce inner friction, leading to improved convergence of opinions, high morale, cohesive maturity, and group's capacity to make faster decisions (Anibaba & Akaighe, 2018; Adeel et al., 2018) which all culminate in "cohesive maturity" (Cole, 2012, p. 36). Likewise, transformational leadership promotes mechanisms to alleviate team conflicts, stimulates creative behaviour, and motivates group members; hence, yields more stability in group dynamics (Chen et al., 2017). Conversely, an autocratic leadership style is expected to restrict the flow of communication among the members leading to reduced efficiency. Similarly, Chen et al. (2017) explain that transactional leadership behaviour might have unintended consequences on group creativity despite sometimes producing satisfactory short-term outcomes. On the other hand, scholarly research warns and provides insights about the drawbacks of informal authority, that manifests itself when leaders with authority do not assume and fulfil their positions, where team members start to capitalize on such weakness, whether actual or perceived, to dominate the decision-making process (Anibaba & Akaighe, 2018; Cole, 2012). Relatedly, there are ambivalent opinions about the positive impact of Theory Y leadership which aims at motivating team members by offering autonomy and abundant opportunities for self-directed problem solving (Bobic & Davis, 2003; Carson, 2005). Controversially, too much autonomy might promote deliberate abuse or be wrongly perceived as less authority or power; hence, undermining healthy group dynamics. Comparatively, Theory X proponents still espouse this combined bureaucratic and adaptive approach to management or leadership for routine and detailed tasks which mandate command and control (Bobic & Davis, 2003).

Fox, Fox et al. (2000) examined the impact of leadership styles on groups performing physical activities and inferred that socially enriched leaders can create a comfortable and cooperative group atmosphere. This converts into socially enriched group dynamics characterized by openness, trust, and collective encouragement, among others. Another example from the healthcare industry asserts that constructive leadership behaviour, based on engagement and justice, is directly linked to elevated levels of team mindfulness and sense of accountability, emotional comfort, systematic improvements, more efficient communication, and consequently higher reliability of health care services (Frankel et al., 2006; Lloyd et al., 2015).

Shuck and Herd (2012) and Northouse (2016), among other contemporary scholars, conceptualize leadership as a complex process centred around influencing teams, groups, and subordinates rather than merely a set of personality characteristics, skills, and behaviours, and further recognize that leadership is contingent to situations, context, and organisational settings. In such framework, leadership is primarily related to leveraging emotional and cognitive engagement in groups to enhance performance and increase productivity.

Equally important, situational communication and dyadic leader-follower relationships are two leadership dimensions that have profound contribution to group dynamics (Lussier & Achua, 2010). Obviously, these two dimensions are connected to contingency theory and situational leadership since both describe the leader's adaptive behaviour based on the characteristics of followers. Situational communication becomes indispensable particularly in insurmountable conditions where a leader should carefully select the methods and techniques of communication based on the situational parameters and variables such as the experience of the follower(s) and objectives of communication. On the other hand, Dyadic relationships, as a governing factor in heterogenous groups, are often linked with the process of forming groups (i.e. in-groups vs. out-groups) where leaders might establish stronger relationships with some followers more than the rest in the group. There is also a reciprocal effect where some followers could hold positive perceptions about the leader while others feel alienated. Consequently, the affected group dynamics could result in five typologies of followers, namely: effective, pragmatic, conformist, alienated, and passive (Lussier & Achua, 2010). The pragmatic type comes at the middle of other typologies and is considered as the most stable for large groups. Accordingly, the proposition that dyads have direct influence on the formation of such follower typologies is corroborated by the leader's ability to transform and move the subordinates/followers from the less desired typologies (e.g. passive and alienated) to the more desired ones (e.g. effective and pragmatic).

In summary, it is evident that leadership as a contingent and situational process, including leader's behaviours and styles, is inextricable from group or team dynamics in several aspects since it is highly correlated to group decision-making, motivation, performance, and the evolution of groups. Further, scholarly literature clearly addresses the complexity of comprehensively defining the mechanics by which leadership directly and indirectly influences group dynamics due to the wide spectrum or mediation and independent variables involved in the process. It is also posited based on the contemporary views of leadership and groups that group dynamics are based on a two-way process that resembles feedback systems (i.e. leader-process-followers); hence putting more emphasis on the concept of systems and its application to leadership and group dynamics. In this respect, the leader's behaviours will trigger different feedback signals from the followers or subordinates based on the heterogeneity of the group and the characteristics of the followers. Such signals in a way or another exemplify the followers' motivation, perceptions of the prevailing leadership styles and the leader him/herself, job satisfaction, and the sense of belonging to the group which essentially are all vital factors for the leader that would allow for a situational and contingent, time varying, recalibration of leadership behaviour and styles in order to lead more consciously and effectively.

2.5.1 Leadership from a Complexity and Systems Thinking Lens

Although many scholars cite leadership as a complex social phenomenon, extent studies are still lagging in defining and addressing the leadership from a complexity and systems thinking lens. Such lag has been recently driving more systematic research that examines leadership in tandem with the various aspects of complexity and systems approach, although most of the studies are qualitative in nature with very few quantitative approaches (Guo et al., 2021). Complexity and systems thinking domains often appear in literature as two faces of the same coin; and sometimes could be thought of as twins with grey boundaries. In the field of dynamical complex systems, these domains become inextricable (Guo et al., 2021).

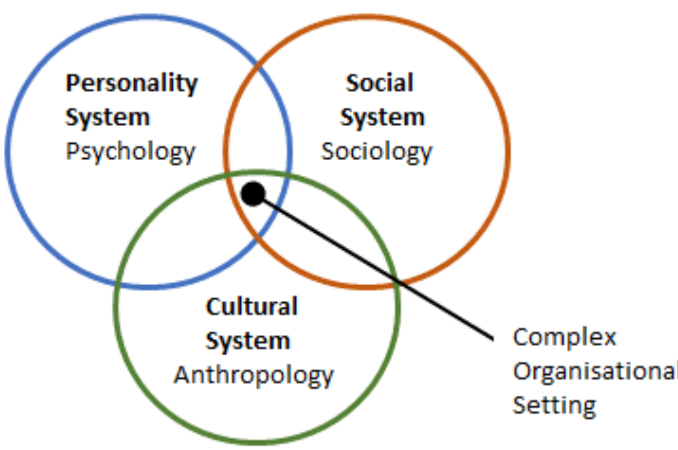
Complexity theory and systems thinking have been gaining more attention from academics and practitioners engaging in the fields of leadership, strategy, marketing, economics, systems dynamics, complexity, and chaos, to mention few. Its contribution lies in moving away from the reductionist view of the world to a more holistic and integrated view of human social systems where organisations are perceived as complex adaptive systems operating within broader and more complex and unpredictable environment, which by itself is considered another system. The System paradigm, which is the coherent and central framework in systems thinking, has been gaining more recognition for being a better resemblance of the reality (Laszlo, 2012). The system paradigm scientifically originated from biological systems and ecosystems that have evolutionary characteristics (Palaima & Skaržauskienė, 2010). A system can be defined as a set of interlinked elements that create a whole where the dynamic and evolutionary properties of the whole are different from the intrinsic properties of the individual elements. Reisman and Oral (2005) define systems thinking as “thinking systematically and paying attention to the dynamic, often nonlinear or stochastic processes of interaction among the resources and the environment within which the system operates” (p.165).

Proponents of systems thinking methodologies perceive organisations as open socio-cultural systems that resemble biological systems in their dynamic self-organising capabilities. These organisational systems comprise cause-and-effect links, known as feedback loops, that exemplify the relational interaction linkages between the different social agents at all hierarchy levels in the organisation. The discipline of systems thinking enables leaders to deal with the complexity and uncertainty dimensions that underlie nearly every business endeavour or project (Palaima & Skaržauskienė, 2010).

Successful leaders in the 21st century foster systems thinking as means of transformative learning to create synergies, to harmonize with the ever-changing business and project environments (Laszlo, 2012) on the micro-and macro-scales, and to address the interconnectivity and causality between the components of a system, whether it is a project, organisation, or the entire economy of a country. As humans, we tend to shy away when the term “complexity” arises and often disagree on what constitutes complexity. What defines an enterprise as complex, and how complexity can be measured. Complex systems are non-linear systems that are built on interdependent elements that have a common goal. They also adapt to environmental factors and constantly exhibit perpetual novelty. Mitleton-Kelly (1998) explains that the complexity of the system emerges from the intricate interaction and interconnectivity of its elements, sub-systems, and its external environment. Complexity is also related to the size of the enterprise or organisation since size is one of the governing factors that affect structural complexity and organisational variability (Dobrev et al., 2006). There are also a multitude of other soft and hard factors that amplify complexity in projects and organisations such as workload pressure, “incomplete information, unknown feedback loops, organisational contexts” (Pagani & Otto, 2013, p.1568), speed of human transactions, information technology, among others (Palmberg, 2009). Mullins (2010) explains that human behaviour cannot be examined in isolation because it is highly contingent to the complex organisational settings, as depicted in figure 2.5.

Figure 2.5

*The complex organisational setting (Adopted from “*Management and Organisational Behavior*”, by Mullins, 2010, p.8)*



Uhl-Bien et al. (2007) contemplated leadership from a complexity and adaptive complex systems lens; and pointed out the entanglement between leader and complexity as means to enable adaptivity, creativity, and organisational learning (Xie, 2019). In this respect, Uhl-Bien et al. (2007, p. 299) define complex adaptive systems (CAS) as “neural-like networks of interacting, interdependent agents” who are acting within the boundaries of a cooperative dynamic system that has a common goal. Ellis and Herbert (2011) refer to CAS as informal collaborative networks of actors who are dynamically collaborating for the purpose of converging to solutions.

The abstraction of organisations as complex adaptive systems, which have complex environments, is clear in the account by Metcalf and Benn (2013) who recapitulate organisational complexity and systems as “complex interconnected and dynamic environmental, economic, and social systems within which businesses are embedded as agents” (p.370). Hartono et al. (2019) studied leadership profiles and asserted that leadership behaviour in the construction industry is moderated by different project complexity levels and contextual factors. Unlike business operations and functional management that incorporate routine tasks and standard processes, projects are unique temporary endeavours that have specific objectives, time and financial targets, in addition to varying physical constraints (PMI, 2017). The unique nature of projects translates into complexity in terms of scope, requirements, size and scale, stakeholders, technology, processes, procedures, and life cycle stages, pressure to meet time and budget targets, and challenges to overcome other constraints. Additionally, projects often generate their own unique problems that are likely to mandate nonstandard problem-solving approaches, techniques, and tools. Therefore, project managers are expected to encounter an array of unique situations and problems that obviously require adaptive and dynamic leadership behaviour and styles (Cao et al., 2021; Hartono et al., 2019). Likewise, public sector projects are characterized by complexity due to the multiplicity of actors and contexts, and often due to the conflicting objectives and interests of internal and cross-boundary stakeholders. Examples of such projects include large infrastructure schemes operated by local governments and funded by international agencies. Therefore, these projects require a nuanced set of adaptive leadership practices to cope with complexity and to balance tensions between stakeholders (Murphy et al., 2016). In contrast to business and administrative roles, project manager face challenges related to project management governance and structure. Nearly in all types of professional services organisations, managerial and staff functions are well-defined within the organisational hierarchy with explicit communication channels. For example, the role of a financial controller in terms of hierarchy, duties, reporting, and communication is almost universal. Conversely, the role of the project manager is far from standard and could take the form of a weak, balanced, strong, and projectized matrix (PMI, 2017). Each of these structures has its own features in terms of project governance, project management autonomy, manageability, complexity, resource planning and allocation, decision-making, and control over subordinates. It is claimed that the projectized matrix structure is recommended for the engineering and construction industry, which is predominantly a project-based business, since it offers power and autonomy for the project manager who becomes the sole leader of the project (PMI, 2017). This type of structure is also common in creative industries which strictly relies on project success (Holzmann & Mazzini, 2020). In other types of structures, such as weak and balanced, leadership could be shared by the project manager and functional managers which consequently adds a degree of freedom from a complexity and systems perspective. Corporations with higher levels of project management maturity usually implement a projectized structure. The different types of project management structures are illustrated in figures 2.6, 2.7, 2.8, and 2.9. Clearly, leadership is shared between the project manager and functional manager in the balanced structure. In this structure, the project manager whose line manager is a functional manager is considered local. Therefore, project leadership might ultimately move up the organisational hierarchy to the functional manager.

Figure 2.6

*Weak project management structure (Reprint from “*A Guide to the Project Management Body of Knowledge”, by PMI, 2013, p.24)

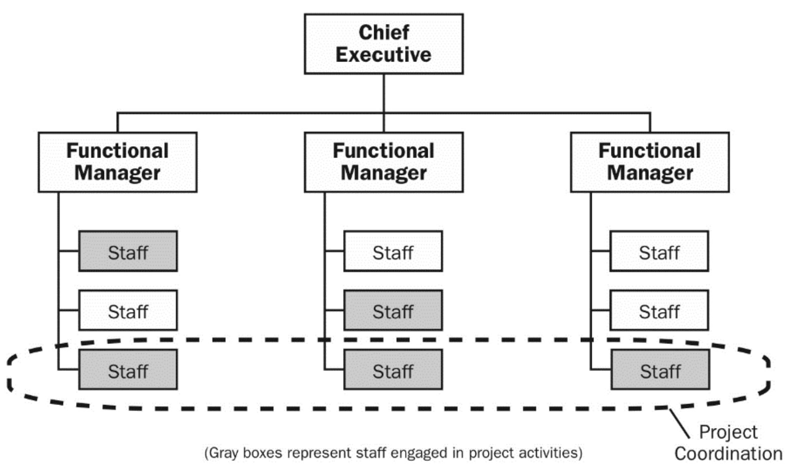
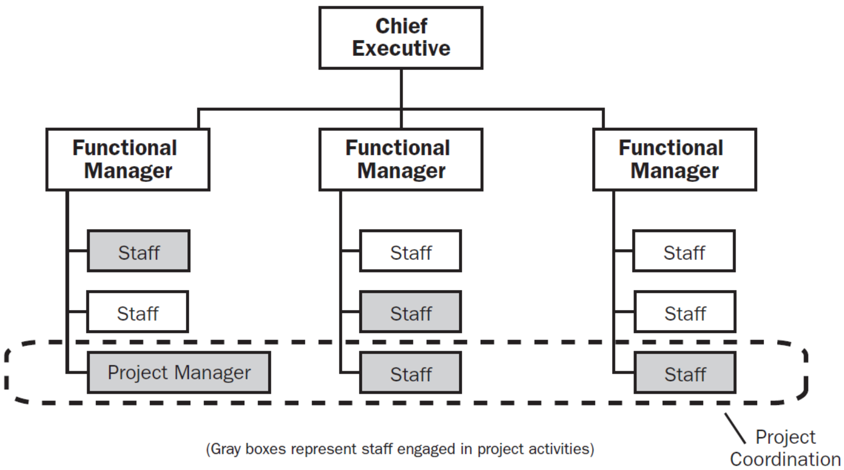


Figure 2.7

Balanced project management structure (Reprint from "A Guide to the Project Management Body of Knowledge", by PMI, 2013, p.24)



Similarly, leadership is shared between the project manager and his/her line manager, referred to as Manager of Project Managers as shown in figure 2.8. The Manager of Project Managers normally leads the project management office. However, the strong project management structure offers more autonomy to the project manager who reports to a central project management office. Depending on the organisational culture, the full power and autonomy could lie with the project management office, with sporadic authority given to the project manager in terms of decision-making and financial management.

Figure 2.8

Strong project management structure (Reprint from "A Guide to the Project Management Body of Knowledge", by PMI, 2013, p.24)

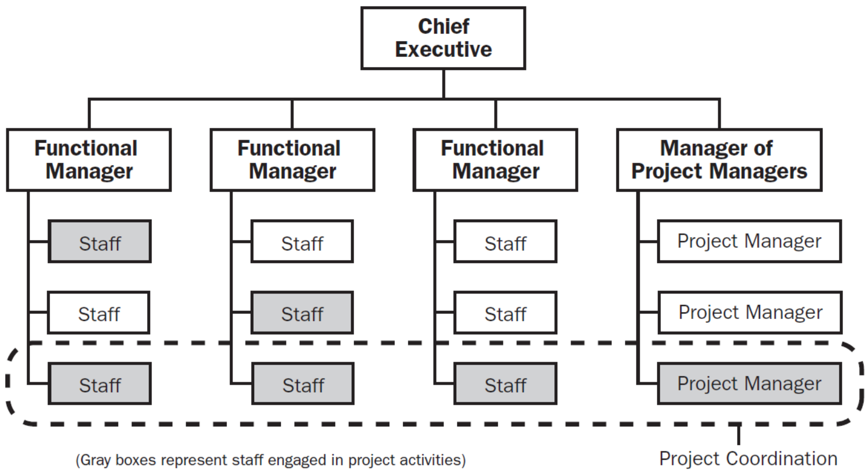
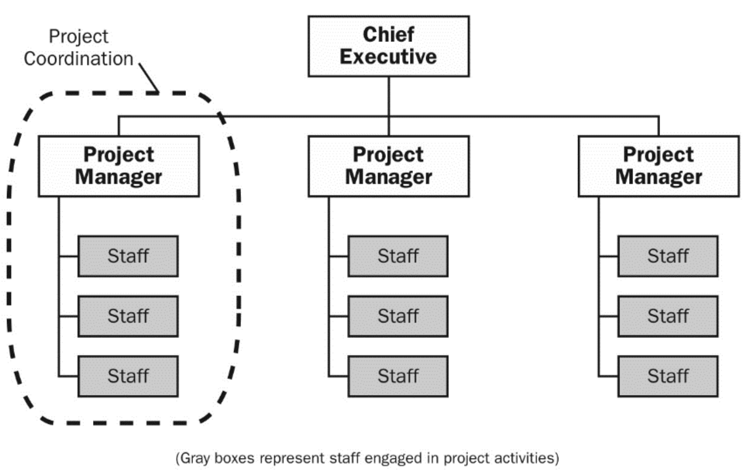


Figure 2.9

Projectized project management structure ((Reprint from "A Guide to the Project Management Body of Knowledge", by PMI, 2013, p.24)



In high power distance cultures, such as that in developing countries, leadership is formal and follows an authoritarian style; thereby giving the functional manager and the Manager of Project Managers full power and leadership over the entire team (i.e. project manager and other team members).

Comparatively, the project manager has full leadership over the project and staff in the projectized organisational structure shown in figure 2.9. This structure offers full autonomy and empowerment to the project manager in terms of resource allocation, hiring and firing, and decision-making. This structure is ubiquitous in project-based businesses, particularly for those who do not operate with separate and independent functional divisions (i.e. subject matter expertise embedded in the project team).

It could be argued that vertical dyads can appear in all types of project management structures, although they are less likely to be found in the weak matrix structure due to the high centralization of each functional business unit where each functional manager has full authority over his/her staff only, whereas the leader-subordinate coordination normally takes place among the functional managers themselves and not between their subordinates.

Most importantly, relational leadership in these project management structures differ based on the leader-follower link since leading project teams is different than routine and traditional organisational management and leadership. In this respect, project managers should balance many competing forces and pressures to acquire resources and develop team members under unique risk conditions and challenging budget and time constraints (Podgórska & Pichlak, 2019). Consequently, the unique nature of projects calls for different kinds of leadership competencies and skills to address such challenges.

Complexity is exacerbated by the presence of human agents who essentially interact with the system's components, and sub-systems, from different frames of reference. Tsoukas and Hatch (2001, p.979) explain that complexity "is not only a feature of a system but also a matter of the way in which we organise our thinking about that system. This second-order complexity invites consideration of the modes of thinking we use to theorize complexity".

Chung and McLarney (1999) pointed out that the conceptualization of organisations as rational decision-makers has its limitations. On one hand, organisations can be treated as social systems with cognitive bias, whereas on the other the social actors could involve in multiple interpretations of the world. These assumptions introduce another dimension of complexity to the process of decision making and leadership based on how the different social actors perceive the system and interpret the world around them. As such, organisations can be perceived as "social systems made up of people, their aspirations, frustrations, egos" where individuals engage in shared strategic decisions making and leadership behaviour (Chung & McLarney, 1999, p.233).

Bennet and Bennet (2014) define complexity as a "condition of a system, situation, or organisation that is integrated with some degree of order but has too many elements and relationships to understand in simple analytic or logical ways" (p.11), therefore complexity would infer a "nonlinearity and unpredictability among the elements and relationships, thus the difficulty in identifying a single or "best" response or solution to a specific issue or situation" (p. 11).

Moreover, the idea that organisations can develop learning capabilities (Xie, 2019) that either reinforce the competitive advantage or, in themselves, become competitive advantages can be framed as a positive feedback effect under the concept of systems (Dickson et al., 2001).

Critically speaking, past attempts to treat leadership phenomenon over simplistically have led to ill-formulated and deficient theoretical formulations and fragile models that fail to capture the holistic systems nature of leadership, and only offer partial understanding of some of its specific dimensions. Clearly, this impedes a more rational and philosophical comprehension of leadership in complex real-life settings such as project leadership. Therefore, it is imperative to go beyond traditional project leadership or management, that is based on negative feedback (i.e. plan, execute, monitor, and control) to more holistic adaptive approaches that can adequately capture the intricate complexity of large systems.

Relatedly, leading projects is similar to a continuous decision making and problem-solving process whereby the project leader is cognitively balancing his/her choices, decisions, and leadership behaviour over time in a feed-back loop to reach a certain state of a system, namely the project. In this essence, the leader’s approach is perceived as a correlational and reciprocal interaction with the system’s elements such as followers, organisational setting, and external business environmental factors. The state of the system, as a project, could be expressed as a multitude of objectives. For instance, a specific system’s state could be defined tangible objectives that the leader is planning to achieve such as time and cost targets. As such, it is absolutely justified to devote adequate amount of conceptualization to the incorporation of complexity and systems thinking when researching leadership phenomenon, and to start synthesizing a systemic evolutionary approach to leadership rather than adopting the mechanistic perspective of leadership behaviour which lacks the human adaptive awareness element.

Although leadership in project management has been studies empirically and theoretically, leadership in the context of complexity and recovery of distressed projects is considerably less researched (Lei et al., 2020). Relatedly, the successful recovery of sinking-ship projects substantially depends on the quality of the reciprocal leader-follower relationships which are exemplified in strong leader-member exchange (Li et al., 2018). Accordingly, a transformational leadership style, that reinforces the coexistence of complexity and systems thinking, comes in handy in such recovery situations.

Systems thinking also form part of the learning organisation (Xie, 2019). Since leadership is one of the building blocks of a learning organisation, if not the most important one, then it becomes logical to think about leadership as a process that encapsulates continuous learning. This bold, and rarely researched, view of leadership leads to more a robust and generalized conceptualization of leadership phenomenon as an organisational learning process in which the leader and followers constantly exhibit self-organising feedback interaction that encompasses a continuous learning part. This definition has three major theoretical and practical implications. Firstly, it abandons the leader-centric view that looks at the leader in isolation from other parts of the process, namely followers and environmental factors. Secondly, it establishes attribution between the leadership process and the organisation, so all leader-follower interactions take place in a medium, namely the organisational structure and settings. Thirdly, it emphasises that leadership process is not static and discrete but dynamically evolving over time in response to influencing variables. For example, the leader might exhibit a directive leadership style with a group of followers over a specific period of time; however, after spending enough time in interactive mutually learning process, the leader might later realize that other styles of leadership can be more effective for leading this specific group under the same environmental factors. Additionally, the leader might further reckon that leadership styles under the second scenario are ineffective under different environmental scenarios. Consequently, a project leader is expected to undergo a continuous learning process thereby rationalizing his/her leadership styles to accommodate a dynamic business environment.

The construction industry is famous for being complex and risky, especially in the case of major projects (Khan et al., 2019). In addition to the complexity inherent in engineering projects, especially mega construction projects (Cao et al., 2021; Damayanti et al., 2021), this industry has been witnessing a considerable increase in the level of complexity over the last decade as a result of globalism, more stringent environmental and governmental regulations, new sustainability and carbon footprint targets, shortage of skilled labour, highly competitive marketplace, advent of technological artefacts, emerging working patterns such as remote work and virtual teams, tighter programmes, and limited budgets (Cao et al., 2021; Hartono et al., 2019). These influencing factors, among others, are intricately interdependent in an indivisible system structure whereby each element of the system is affecting and is being affected by other factors. Generally, organisations have been increasingly operating in complex business environments where significant changes are occurring due to globalization, new technologies, climate change impacts, and geopolitical forces that create turbulence and uncertainty for the delivery of strategic projects (Hitt et al., 2010). Damayanti et al. (2021) interestingly draw attention to the scare treatment of complexity in research pertaining to project management and leadership, and point out that among the relevant studies, undertaken between 2007 and 2018, only a small percentage tackles the complexity dimension.

Complexity and systems-based nature in mega and giga projects stem from the large scale of physical assets and high monetary value, ambitious objectives, complex networks of intercountry and transboundary stakeholders, technical and technological novelty, multi-national societal interface, institutional complexity, dependency on the dynamics of global economy, in addition to a multitude of constraints related to budget and schedule (Cao et al., 2021; Damayanti et al., 2021; Khattak & Mustafa, 2018). Holweg and Maylor (2018) point out that the large budget and significant scale of managerial structure inherently makes mega projects as complex and a strategic risk for the involved organisations. Some examples of major, large budget, projects include high-speed rail, urban infrastructure, dams, canals, nuclear power plants, space exploration, and science technology projects such as atomic particle colliders. Interestingly, there is no lack of analysis and identification of the recurrent problems faced in mega projects, nevertheless, a high percentage of such projects still fail due to deficiencies in the treatment of inherent complexity and the implementation of systems-based leadership (Holweg & Maylor, 2018; PMI, 2014). Accordingly, it could be claimed that large projects resemble complex systems that induce complex and wicked problems, and which require an adaptive and flexible project management leadership and strategy to overcome the myriads of difficulties and challenges encountered in such projects (Damayanti et al., 2021). Although adaptive leadership is imperative to copy with complexity, some research

(Khan et al., 2019) found that specific leadership styles are still most preferred in construction projects such as transformational leadership. Such studies were specific to certain national cultures, incorporated a limited in the number of variables, and did not assert the influence of complexity and systems features found in large projects. Additionally, the internal and external variables, that characterize the project as a system, evolve and vary over the life cycle of the project. Therefore, the traditional view of leadership as a static process, with expected outcomes regardless of inputs, no longer hold and this consequently warrant an in-depth consideration of the dynamic nature of leadership in addition to fostering the concept of shared leadership (Cao et al., 2021). Shared leadership assumes the leadership styles and behaviour cannot be attributed to a single leader, particularly in mega or giga projects, but can be transferred horizontally and vertically among other actors within the boundary of the system such as followers, functional managers, deputy project manager, and senior management (Cao et al., 2021). In the same spirit, shared leadership is concerned with the collective knowledge and performance of the group rather than the behaviour of the individual leader (Ererdi & DURGUN, 2020). Although shared leadership is generally under researched, and usually ignored, it is a crucial dimensional component of the leadership construct that cannot be simply discarded, especially for the case of large projects with layers of networks. Likewise, it could be argued that the less attention given to systems thinking in project leadership has been bringing a heavy toll on global engineering companies in terms of projects ending behind budget and schedule. Renowned scholars such as Senge (2014) and Ackoff (2015) had clearly highlighted the consequences of such negligence of systems thinking on humanity.

Other scholars like Kotter (2000, as cited in Bohl, 2019), posit that the role of management is about coping with complexity whereas leadership is concerned with organisational change. This perception is arguably inaccurate because one of the leader's main roles, especially in project management, is to cope with complexity by understanding its impact the project and team members. Complexity is not exclusive to organisation-wide matters and can be encountered in any enterprise in a variety of forms. For instance, challenging software development and engineering construction projects often show technical complexity exemplified in complicated scope and requirements, large teams, multiple stakeholders, problematic logistical and geographic matters, among many other complexity dimensions. Therefore, it is expected that a successful project leader can cope with such complexity by selecting optimal leadership styles to ensure the followers are motivated and performing.

Organisations are complex open systems that do not exist outside the influences of the external business environmental factors such as market dynamics, political tensions, governmental regulations, rivalry, among others (Bohl, 2019). As complex systems, organisations can exhibit stability and internal linear relationships (hierarchy), under certain circumstances, or otherwise undergo cyclical variations and chaos when internal relationships and dynamics become nonlinear particularly in high uncertainty and ambiguity conditions. Since organisations need to adapt, they highly correlate to Complex Adaptive Systems (CAS). Similarly, projects exhibit the same nature of combined linearity and non-linearity depending on numerous situational factors. For instance, in complex projects that employ large global multi-national teams, the project leader's interactive and reciprocal relationship with team members is far from being linear that follows a clear chain of command.

Clearly, leader-centric leadership theories utterly fail to account for the complexity dimension since they exclusively examine the leader in isolation of the influencing factors, whether internal to the organisation or team or external to the team. As such, process-based leadership theories that adopt mutual reciprocal interaction between the leader and followers have proven to be more successful at explaining situational leadership behaviour.

Bohl (2019) points out that complexity even goes farther by driving a more radical framing of leadership beyond the granular analysis of causality between leaders and followers to a more phenomenological perspective of leadership as a practice, recently coined as Leader-As-Practice (LAP). The modern concept of LAP considers leadership as a collective continuous process, rather than a discrete cause-and-effect interactions, that inextricably relies on the leaderful engagement of the leader and the followers to collectively improve performance and achieve goals. In engineering project management, the framing of leadership as LAP resonates well with the dynamic and fast-paced nature of projects, especially for the case of large complex projects. Recently, complexity has been aggravated in engineering projects by the global pandemic conditions. It is essential that project managers or leaders adapt their leadership styles to such uncertain conditions in order to keep followers motivated and be able to deliver projects especially in the construction industry (Boonyathikarn & Kuntonbutr, 2021).

Head and Alford (2015) explain that complex situations, involving such wicked problems, require a higher level of management and leadership, particularly due to the differences that modern social groups exhibit in terms of values and perspectives; that eventually limit the possibility of clear and agreed solutions. Kreuter et al. (2004) held equivalent opinions about complex situations where problem-solving becomes a social and political process as well as a technical or planning problem.

The classical management school, founded by Taylor's ideas and concepts, views organisations as a mechanistic whole with specific components and one-way goals. In such organisational typology, the problem-solving process focuses on efficiency and productivity regardless of human relational links that involve emotional intelligence and cognitive capabilities. Conversely, a systems approach defines an organisation as a complex landscape of interlinked human-based constructs which continuously interact and exchange information with the inside and outside environments through their preamble boundaries. For instance, economy is considered as a complex adaptive system that is never in equilibrium, and which rarely achieves optimality (Gintis, 2006) thereby being characterized as dynamic and non-linear. Checkland (2012) supports the value of systems thinking in organisational leadership because it shows more effectiveness and efficiency in solving complex, ill-defined, and ambiguous problems.

The core principle of systems thinking is the realization of the concept of *whole* which possesses its emerging properties throughout the interaction between its elements and sub-systems (Checkland, 2012). Mingers and White (2010) further emphasise on the emerging properties of systems by recognizing that the relationships between the elements of a system are more important than the elements themselves in determining the specific behaviour of the system in hand. Kaspary (2014) also stresses on the interdependency in systems thinking where a “system cannot be a system itself without the presence of interaction between its parts” (p.657).

Stasinopoulos et al. (2009) point out that best practice in systems engineering still performs reductionist analyses of engineering problems; however, without ignoring the fact that one component of the system interacts with and affects all other components which in turn affects the behaviour and characteristics of the whole. Furthermore, the definition of a system is not a straightforward exercise and depends on the relative review of the observer who is delineating the system boundaries, therefore “whatever is considered to be the whole might itself be seen as part of a yet larger whole” (Checkland, 2012, p.466). The various parts of the system dynamically interact with each other and with their environment through mutual positive and negative feedback processes. Senge stipulated that positive feedback loops in systems, alternatively known as self-reinforcing loops, tend to reinforce change, while negative feedback loops, known as self-correcting, tend to oppose change, thus ensuring that a variable within a system remains constant. Methodologies of systems thinking have been extensively applied in natural and social sciences. The most known and profound methodologies mentioned in literature are soft systems thinking and hard systems thinking. In soft systems thinking, mainly represented by soft systems methodology, there are multiple definitions of problem objectives which themselves change over time (i.e. multiple ways of perceiving the world), yet they collectively converge to purposeful action in the “pursuit of a well-defined objective” (Checkland, 2000, p.S14). Therefore, soft systems thinking is concerned with “identifying the correct problem” (Reisman & Oral, 2005, p.165). The conceptual system or systems are used as learning device to inquire the real-world entities through a systemic process of engagement (Checkland, 2012). Comparatively, hard systems thinking follows the classical management school in the sense that the system's performance objectives and the problem are well-defined. Such definitions of objectives by soft and hard systems thinking have significant implications on leadership behaviour. Soft systems thinking methodology infers that leadership should be transformational and adaptive in order to inject creativity and innovation in the system. This consequently leads to effective problem solving, especially in complex situations. Whereas the mechanistic approach by hard systems imply that direct formalized procedures are best suited for followers, hence, an authoritarian leadership style would be more beneficial in this case. Accordingly, the system whether soft or hard could be leadership-engineered to achieve the prescribed objectives (Checkland, 2012). Caldwell (2012) explains that hard systems thinking is more formalized, and "tends to be objectivist and expert driven" (p.151) and positivistic based on linearity and the number of direct cause-and-effect links that exist in the system. In comparison, soft systems thinking is interpretative and reflects the observers defined in the systems. Worth noting, some scholars like Reisman and Oral (2005) see that soft and hard systems thinking are compatible and not mutually exclusive, where both approaches can be exploited at the various stages of the managerial problem-solving process.

The great benefit of soft systems thinking comes from its capability of tackling complex situations and systems, although there is still "no consensus around when a system should be regarded as complex" (Tsoukas & Hatch, 2001, p.985). Similarly, Checkland and Poulter (2010) mention that soft systems thinking is an action-oriented process of enquiry into problematic and messy situations where learning emerges through an organised process in which observers explore the situation through a set of models of purposeful action.

Jacobs (2004) used examples form the National Health Service system in UK to highlight the benefits of applying soft systems thinking to engage stakeholders in the modelling of purposeful activity systems. Similarly, Pagani and Otto (2013) employed a social-economical systems approach coupled with system dynamics simulation to study marketing strategy and decision-making in the pharmaceutical industry which is a complex system of multiple agents including government, health care system, doctors, patients, sales personnel, among others. Their findings show that employing systems thinking can help marketing managers in creating better problem definitions and provides a deeper understanding about the effects likely to result from alternative responses to those problems, hence using high leverage point in the right direction instead of following the normative tendency of people to act in the wrong direction.

The neoclassical management science paradigm is focused on problem-solving, which could be visualized as an optimisation with constraints problem, but not on the definition of the system in which the problem arises (Reisman & Oral, 2005). Therefore, the value of applying systems thinking to fields such as leadership and project management is justified through the advantages offered by systems thinking to define complex problems relevant to project execution, stakeholders' interests, and other organisational objectives.

Additionally, strategic thinking is central in organisational leadership. Therefore, systems thinking, and complex adaptive systems methodologies, offers robust means to conceptualize strategic leadership in organisations in a similar fashion to leadership in complex projects.

In the domain of project management, task complexity has a moderating effect on the leader's attempts to motivate and empower followers. In the case of transformational leadership, it could be argued that the follower's desire to learn, self-develop, persevere, overcome task challenges, and consequently demonstrate innovative behaviour have a moderating effect on transformational leadership at the individual and group levels. In this respect, Afsar and Umrani (2020) critically establish a contrast between the claim that complex task environments are catalysts for self-autonomy and supportive culture, in high empowerment business environments, where leaders can exhibit transformational leadership qualities and encourage self-determination, and the hypothesis that low empowerment environments have a positive moderating effect on transformational leadership, therefore, the followers' innovative performance will be highly impacted by the transformational leader behaviour and will increase if empowerment environment is low and vice versa.

On a project scale, major projects can justifiably be perceived as standalone organisations with dedicated governance, policies, protocols, and procedures. Sometimes such projects are geographically based in remote areas and have dedicated infrastructure services and facilities, so they could be claimed as standalone organisations in their own right. As such, leadership in such pseudo-organisations shall embrace strategic holistic systems thinking to ensure survival (Self et al., 2015). With systems thinking approach, strategic leadership can help in identifying how ambiguity and chaos exist in the project's life cycle, and how leadership can influence project delivery through situational and context-specific feedback dynamics between the internal and external organisational environments (Fairholm & Card, 2009).

Likewise, the view of strategy making as a dynamic and responsive process within an unpredictable environment fits more closely with the concept of systemic strategic planning. The successful or “realised” strategies are often “emergent” strategies that have evolved as part of a “pattern in a stream of actions” (Graetz, 2002, p.456). This perspective of strategizing through systems thinking coincides with the concept of strategy-as-practice where strategies emerge following a bottom-up engagement and interaction of human actors and organisational artefacts in the form of a complex double-loop process of knowledge creation (Salmador & Bueno, 2005). A similar systemic concept of defining leadership as a practice in given hereinafter.

It is vital to stress that human beings do not interact according to mathematical algorithms. To the contrary, they have cognitive faculties which enable them to change the rules of interaction. In chaos theory, which is highly connected to complexity theory, the iterated formula remains constant while complex systems are capable of evolving and changing the rules of interaction (Mitleton-Kelly, 1998). According to Jarzabkowski and Kaplan (2010), strategic leadership emerges over time with the interaction between the social actors within and outside the organisation and can be perceived at different levels of analysis (i.e. the actor, decision, project, or strategy).

Graetz (2002) adds that strategic thinking reflects a holistic systemic view of the organisation where the system’s parts interact embodying a focus on intent and improving the situation rather than focusing on accomplishing a “fit” based on resources and opportunities. Strategic planning is upward looking at ensuring how tactics link up to organisational goals and strategies. It is focused on control, prediction, and analysis. However, anomalies and limitations of human behaviour play a pivotal factor in making organisational control difficult to achieve (Fairholm & Card, 2009). This definitely has implications on leadership behaviour where control, discipline, and goal achievement are expected outcomes of the leadership process. Maranville (2011) elaborates that the paradigm of science, with its analytical focus, formalized systematic processes, and artistic paradigm, by which true strategic value emanates, are philosophical lenses through which the phenomenon of organisational action can be observed. Both paradigms, with their distinct and essential characteristics, complement each other.

Houchin and MacLean (2005) mention that “complexity theory has been advocated as a way to help understand organisational change and innovation” (p.149) and “complexity theorists see organisations as complex adaptive systems” (p.151). Such concepts had brought insights to leadership by viewing organisations as non-equilibrium learning systems (Xie, 2019). Although Senge focuses on the concept of learning organisations, his concepts have recently been argued by Caldwell (2012) as theoretically flawed because it cannot theorize the organising practices by which learning and change occurs, and for increasing the dispersal of human agency, power, knowledge and autonomy within the workplace. Ing (2013) points out that learning and coevolving are ways in which systems can react or respond to changes in their environment.

The importance of systems approach in leadership and complex problem-solving is highlighted by Ackoff (2006) using the two types of errors that people normally make, namely, errors of commission and errors of omission where the former type is less important. Contrary to what one might think, errors of commission constitute a means of learning whilst errors of omission assimilate the ignorance of a system element thus not treating the whole holistically. The error making and correction cycle resembles a feedback loop in which a leader learns from the reciprocal interaction with followers and accordingly adjusts, or adapts, his or her leadership behaviour based on responses of the followers, which can be perceived as error signals.

Jarzabkowski and Paul Spee (2009) views on strategy as practice, that involves human interactions outside and inside the organisation, and praxis (stream of activity) through which the strategizing takes place, motivate the application of the same systems concept to leadership. The variation of practitioners and praxis at macro, meso, and micro-levels produces many typologies of leadership. Similar to strategy, leadership cannot be viewed as a one-off decision endeavour but rather the output of complex processes (Johnson et al., 2007).

As another example of fostering systems thinking to model complex real-life situations, Jarratt and Stiles (2010) employed an activity theory framework to study strategizing practices by senior executives in various UK industries. The implementation of an activity system framework allows the investigation of strategy with emphasis on activity, human actors, the tacit knowledge of how strategizing works, knowledge creation and re-creation, and the interactions within the organisation activity system. These practices are shaped by the leader's view of the operating context and by his/her competitive strategy perspective and could be described by the interaction between the strategic leader, the strategizing practice, the collective organisational structure and the strategy mediation tools, methodologies and frameworks. Their study can be innovatively mirrored to leadership behaviour in engineering projects to synthesize different leadership typologies. Firstly, a routinized leadership behaviour can be characterized by aligning the organisational vision and goals with the project's objectives where the project's environment is considered predictable and an extension of the organisational environment. In this case, leadership can be leveraged by using strategic project management methodologies such as risk and stakeholder analysis.

Secondly, leadership can be centred around influencing the possible futures of the complex and dynamic environment, by embodying learning and creativity to proactively drive followers and to instigate initiatives by stakeholders. This type of leadership behaviour embraces bidirectional interactions between all social actors, and could be of incremental (Bantel & Osborn, 1995) or breakthrough nature. This concept of emergence in leadership is clearly echoed in the learning and environmental strategy schools by Mintzberg and Lampel (1999) who adapt chaos and evolutionary theory in emergent strategies.

Thirdly, leadership can become an imposed practice that is formally implemented under stable and complex operational environments. Such approach is largely influenced by organisational learning processes and feedback from the external environmental. In this case, leadership emerges incrementally and improves over time due to feedback from the complex system actors. In this respect, predictability of future events (Hitt et al., 2010), changes in stakeholders' behaviour, technology, and globalization are considered as external signals that recalibrate leadership behaviour.

Alongside systems methodologies, activity theory enables a humanized approach to exploring leadership. Activity theory incorporates emotions, motivation, and human interaction. As discussed earlier, these are fundamental constituents of transformational leadership. Therefore, the use of an activity framework such as that in Jarratt and Stiles (2010) could be advantageous in capturing the influence of complexity on adaptive leadership practices, thereby providing means to understand how emotions and motivation affect human thinking about resolving complex problems (Metcalf & Benn, 2013).

In summary, systems thinking offer robust and flexible models, constructs, and methodologies to the study of leadership behaviour in complex environments. The conceptualization of a social system as a “whole” with emerging characteristics due to the interaction of its components resembles the structure and complexity of organisations and their interaction with the external environment. Systems thinking also has positive contribution to transformational leadership as a preferred leadership style when confronting “divergent views about the definition” of project problems (Mingers & White, 2010, p.1151). As Senge (2014) points out, the discipline of systems thinking lies in the mind shift of seeing interrelationships instead of cause-and-effect links, and processes of change instead of snapshots.

Accordingly, project leaders may opt “not to analyse but to think more holistically” (Checkland, 2012, p. 466) in terms of the system they operate within whether that is a project or the entire organisation and where both, the project and the organisation, are prone to dynamic changes. Adaptive leaders shall not be blinded by static trends and shall observe the internal and external environments they operate within to avoid the “dangers inherent in being blinded by past success” (Chung & McLarney, 1999, p.241) and to continually assess the need for developing “new systems concepts as a response to the complexity” of their projects (Checkland, 2000, p.S11).

2.5.2 Leadership Contingency to Organisational and Environmental Factors

Although the influence of enterprise environmental factors and organisational factors on leadership is generically cited in extant literature, it is seldom to find scholarly research with satisfactory structured empirical evidence on the relationship between leadership behaviour and these crucial factors. Relatedly, available studies merely investigate one or two variables in isolation of the whole system. As mentioned previously, such isolation results in a sub-system that does not accurately portray the dynamics taking place within the original system, and many of the existing multi-directional interaction with other organisational and environmental elements of the system are ignored in a risky way. Organisational factors (OFs) are considered internal to the organisation whereas enterprise environmental factors (EEFs) are commonly external to the organisation (PMI, 2017) although they sometimes refer to internal and external factors (Guo et al., 2021). OFs comprise nationality, culture, organisational size and structure, project management maturity, project delivery governance, and technological infrastructure, among others. EEFs include public policies and regulations, local legislations, stakeholders, logistical restrictions, customer nationality and organisational culture, among others. OFs and EEFs are among the main input variables incorporated in the conceptual and theoretical frameworks implemented in this research as shown in Section 1, figure 1.1.

By overviewing the number of potential factors in OFs and EEFs, it could be argued that capturing the impacts of these factors is a tremendously tedious and time-consuming process since it requires rigorous longitudinal examination of leadership behaviour and styles in organisations with different structures and varying external environments. This is practically cumbersome and expensive, and probably demands large scale studies that can span over several years due to the multitude of variables that are worthy of consideration.

Ererdi and DURGUN (2020) point out that the size and climate of the organisation are important moderating variable affecting leadership and organisational performance. Size affects structure, governance, and either enhances or inhibits the leader’s control. Similarly, organisational climate directly affects transformational and transactional leadership. For instance, the level of clarity with which information flow vertically and horizontally throughout the organisation is related to the leader’s ability to communicate vision clearly to the followers. As discussed in the previous sections, such clear communication of vision is pivotal in transformational leadership that focus on surviving organisational changes. Ererdi and DURGUN (2020) further explain that environmental uncertainty moderates the influence of leaders on followers whereby followers seek charismatic leadership to feel safe in times of uncertainty and volatility.

Organisational culture is arguably one of the most researched OFs due to its profound role in organisational performance and design. Mandal (2011) states that culture is the “personality of the organisation” (p. 349). Organisational culture is a complex multi-dimensional construct with numerous controversial dimensions. In this respect, it is hardly a surprise to see that most of the renowned models on organisational culture, such as Hofstede and GLOBE, had received some criticism in terms of validity and reliability (Venaik & Brewer, 2013). Furthermore, organisational culture elements are often metaphorically concatenated with the iceberg where the visible formal culture elements, such as goals, technology, structure, and policies, represent the tip of the iceberg whereas the much larger underwater portion of the iceberg exemplifies the hidden informal culture elements such as perceptions, attitudes, affection, informal interactions, group norms, among many others (Gardašević et al., 2021). There are different classifications of organisational culture, and most of these classifications are based on the degree of risk taking, hierarchy and structure, decision-making process, mobility of information and actions within the organisational system, speed of responsiveness and feedback, and emphasis on quantitative rather than qualitative measures. These cultural dimensions are inextricably linked to leadership behaviour and styles in the organisation.

The organisational identify might conflict with other employees' personalities if there is no intersection between core values, goals, beliefs, assumptions, vision, mission, and other traits. Therefore, cultural values and orientations that are in continuous interaction with leadership behaviour are expected to influence the outcome of the leadership process. Organisational culture further defines the measures that are normally undertaken to manage change (Lundberg, 1990).

Globalization has transformed modern business into a cross-cultural enterprise, and it is becoming more common to see multi-national teams from different countries collaborating on large projects. For instance, many international engineering firms have offshore design office, commercially known as cost centres, that contribute to project delivery at home countries. This means that leaders nowadays are inevitably exposed to different nationalities within the same team where each nationality has its own customs, values, rituals, symbols, and perception of leadership. Therefore, leaders should be attentive to the response of different national cultures to the various leadership styles (Gardašević et al., 2021). Bird and Fang (2009) stress on this perspective and state that the “paradoxical movement of cultures” and the “emergent global cultures” began to transcend national boundaries as indigenous cultures became exposed to foreign cultures (p. 140). Subsequently, it might be plausible to claim that the effect of the internalised corporate culture is becoming more dominant than national or societal cultures. Sustainable organisational culture should be designed, or engineered, to align people with the organisation and to achieve organisational objectives. As such, it is essential to contextualize leadership behaviour by accounting for organisational culture as a moderating variable (Langstrand, 2016).

Equally important, national culture has also a direct impact on dominant leadership behaviour and styles. National culture can be identified based on four criteria, namely: power distance, uncertainty avoidance, collectivism, and feminine values (Gardašević et al., 2021). Power distance is concerned with the democracy of expressing opinions and participating in decision-making without organisational hierarchy barriers. This drives intellectual stimulation and innovative and leads to improved performance. Uncertainty avoidance refers to the process of decision-making. High uncertainty avoidance means more aversion to encountered risks whereas low uncertainty avoidance comes with more appetite for risks where people are willing to take risks for greater rewards. Some business environments thrive in such low risk-aversion atmosphere. Collectivism, which is the opposite of individualism, expresses the extent to which the group interest takes precedence over personal interests. In collective cultures, people’s personal interests come as a secondary objective to the collective social goal and the greater good for the group. Such cultures nurture values such as harmony, security, stability, respect, and empathy, and look for charismatic leaders who appreciate the common vision and goals rather than focusing on their own targets. A feminine culture is people oriented and is characterized by less aggressiveness and domination. Feminine cultures are more prone to negotiate and consensus. In contrast, a masculine culture is task-oriented and exhibits assertiveness, and leaders have the typical male qualities (Gardašević et al., 2021).

Followers from developing countries have less proactive personality, high power distance, and higher levels of risk avoidance, hence they expect direct guidance and clear instructions. Therefore, these cultures react more effectively to the authoritarian leadership style which is characterized by command-and-control and centralized decision-making. Authoritarian leaders have instructional behaviour and autocratic styles. They expect obedience from followers, tend to hide information, and give less care to innovative contribution by team members (Gu et al., 2018). Although authoritarian leadership is often perceived as destructive, anti-creative, and counterproductive (Gu et al., 2018), it could still bring positive outcomes in less democratic cultures. Comparatively, transformational and democratic leadership styles which embrace autonomy and empowerment might give negative outcome on task performance and inadvertently result in the perception of leaders as passive and Laissez-faire or even incompetent (Colman & Lion, 2021; Gardašević et al., 2021). Notably, the recent pandemic, that significantly slammed businesses globally, was a game changer and resulted in more dependence on virtual teams; thereby drawing more attention to the vital moderating role of national culture on remote team leadership and management. Expectedly, cultures that shy away during face-to-face interaction have more tendency to disengage during virtual meetings to avoid any embarrassment in the event of making mistakes or being misunderstand due to language and oral communication barriers.

For instance, project managers from non-western cultural backgrounds hold different opinions about leadership, and about how projects should be managed. Consequently, different management and leadership styles are evident in such cultures.

Another example from developing countries in the Middle East shows that leaders are more inclined towards coercion and command-and-control, whereas the dominant leadership styles in the developed countries are more oriented to coaching and democracy. However, it could be argued, based on empirical evidence, that both styles in developed and developing countries share a great deal of appreciation towards systemic and systematic management methodologies which call for formalized task-oriented leadership behaviour.

Yuan et al. (2018) used perceived organisational support and leader competencies as mediation and moderating variables to investigate the curvilinear relationship that links leadership with cultural dimensions in a Chinese context. They collected samples from 113 leader-subordinate dyads, and corroborated that a self-aware, open-minded, and humble transformational leader can more actively respond to feedback by followers, and can subsequently engage with respectful reciprocal interaction with the followers to motivate them and to ensure improved task performance. However, the authors emphasised that there is a certain threshold beyond which superfluous humble leadership can result in negative outcomes especially in cultures that are more oriented to the authoritarian style of leadership. Similarly, too little of authentic humility might be damaging to collaborative engagement between leaders and followers. This is relatively congruent with the outcome of other scholarly research that calls for a balance between people-oriented transformational leadership behaviour and task-oriented transactional leadership behaviour (Kerns, 2019).

Vilas-Boas et al. (2018) generously described the contextual correlation between leadership and culture on the empirical grounding that leadership is a collective social interaction mechanism that has a direct link with knowledge and organisational learning (Xie, 2019). In this respect, leadership enables the development of solutions and resolution of problems by facilitating the dynamic interactions between people, artifacts, and systems. Alternatively viewed, leadership is the leverage arm that positively reinforces the myriads of multi-directional interrelations between the social agents and their context and environment in order to achieve project or organisational objectives and goals. A critical reflection on this relatively interesting and paradoxical view of leadership implies that leadership is not only a standalone process, by virtue of its own phenomenological structure, but can also be perceived as a mediating and reinforcing input variable to the habitual practice of the daily organisational life. Therefore, leadership can be constructed as a process with input and output variables, and could itself be an input variable to an organisational process.

2.6 Summary

Leadership is irrefutably one of the most demanding qualities for successful project management and delivery (Bennett, 2018; Bossink, 2004; Cao et al., 2021; Holzmann & Mazzini, 2020; Khan et al., 2019, Liu et al., 2019; Mufaricha et al., 2021; Munir et al., 2017). Despite its importance, a deep understanding of this elusive social phenomenon is still narrow due to many reasons (Laszlo, 2012; Turner & Baker, 2018) and leadership theory, in general, suffered from a “widespread misperception” during the twentieth century (Megheirkouni, & Mejheirkouni, 2020, p.104; Murphy et al., 2016). Arguably, this was mainly attributed to the domination of the legacy leader-centric approaches, which romanticize leaders as the key heroic figures in the leadership process, and the critical gap in the ontological and epistemological abstractions of leadership (Vaagaasar et al., 2020) whereby little attention was given to the dynamic, process-based, complexity, and systemic conceptualizations of leadership (McLaurin, 2006; Murphy et al., 2016; Turner & Baker, 2018). There is limited coverage of such comprehensive conceptualizations for the case of the engineering, construction, and creative industries (Holzmann & Mazzini, 2020). Nevertheless, it is fair to say that the critiqued rigid notion of leadership as a person-centric static process is quickly being abandoned and replaced with the modern thesis on leadership which is underpinned by dynamic relational leadership approaches based on complex multi-directional and multi-actor structures. There are also new emerging perspectives that diverge from the formalized top-down leadership to the entangled horizontal and vertical shared leadership structure (Murphy et al., 2016).

Accordingly, a robust and reliable conceptualization stems from the treatment of leadership as a complex multi-layered social phenomenon that is dynamically conditioned by numerous interlinked situational and contextual factors pertaining to organisation and external environmental factors. Leadership is also considered as a dynamic process that has bi-directional interactions between the leader and followers, who reciprocally affect each to effectively achieve collective leadership by the group. These mutual interactions, coupled by followers' characteristics and other situational factors, define the dominant leadership behaviours and styles exhibited by project leaders. The multi-dimensional nature of leadership behaviour, which is also moderated by numerous interconnected organisational and environmental factors, has been driving scholars to take the system paradigm, and systems thinking, into serious consideration when investigating leadership. Courageously, some scholars further stretch the need for more advanced abstraction from systems thinking to “systems being” to expand our consciousness by moving from “awareness to embodiment” and cope with the evolution found real-life systems (Laszlo, 2012, p.101). Modern leadership thinking is even going father by borrowing concepts from mathematical dynamic systems and chaos theory (Palaima & Skaržauskienė, 2010; Skaržauskienė, 2008) which not only proven to be of benefit for scientists but also for businesspeople to better understand the evolving realm of organisational and leadership behaviour, and to prepare for future leadership that can effectively address the challenging of the dynamic and complicated world.

Organisations worldwide have been experiencing challenges due to the uncertainty of global economy, globalization, political instability, increased institutional complexity, among other factors (Pretorius et al., 2018). As such, organisations have been responding to these challenges and evolving into more complex, dynamic, and systemic organisms with highly interdependent societal dimensions (Nicolaides & McCallum, 2013). Complexity is further augmented in AEC projects which are inherently complex by nature (Khattak & Mustafa, 2018; Potter et al., 2017; Pretorius et al., 2018). This state of complexity puts more emphasis on the contextual and situational treatment of management and leadership theories, concepts, and models, and sheds lights on the importance of adaptability and effective change management. The success of change management, within contemporary complexity, is highly dependent on a combination of contextual and situational leadership styles which can cope with the interdependent interaction between organisational institutional, cultural, and social systems and artefacts, as mentioned in section 2. Davis (1997) stresses on the contingent approach, so for example when short-term economic objectives and productivity are the main situational concern a control-oriented methodology and styles might yield better outcomes. The complexity view of projects suggests that leadership behavior is expected to adapt to the various contextual and situational variables in order to maintain order, stability, control, innovation, and transformational changes in organisations (Murphy et al., 2016).

Moreover, it is essential to study leadership theory as a multi-directional and multi-dimensional process-based phenomena, by analysing the intertwined time-varying implicit behaviours of all social actors in the system. Schedlitzki and Edwards (2014) pointed out that the increasingly critiqued mainstream leadership theories which focus on the leader in a unidirectional fashion merely look at a one-direction influence on followers. The authors emphasise the need for longitudinal studies to explore the temporal adaption of leaders to situational changes over time. Plausibly, “there is not a single dimension” that is considered as the controlling factor of leadership behaviour; but rather all aspects of leadership may be parts “of an interrelated whole” (Campbell, 2007, p.137). Vecchio et al. (2006) also corroborate that organisational effectiveness can be improved if leadership “behaviour is guided by valid principles that are grounded in empirical research” (p.407).

Also in the context of leadership, some research honour classical management whilst others bring aggressive criticism in the name of the social and human dimensions. In contrast to recommendations on low-centralization and formalization (Hirst et al., 2011), it could be debated that there should be a balance between the scientific and transformational organisational practices, formalization against decentralization of decision making, and the emotional treatment of employees' motivation to produce a creativity-thriving business and project environments while concurrently avoiding the tendency to compromise performance. Some scholars like Grachev and Rakitsky (2013) also take a balanced view about Taylor's scientific management in the context of modern leadership in complex socio-economic and political settings.

Among the most cited leadership styles, transformational then transactional leadership were found to be effective in project leadership (Andi et al., 2021; Liu et al., 2019; Potter et al., 2017; Rogo et al., 2020) as long as there is a balance between these two styles to ensure systematics, disciplined, and innovative approaches to task performance, and to maintain motivated and empowered groups and team members who share the leader's vision and feel leadership presence (Kerns, 2019). Transformational leadership also contributes to innovation and creativity in construction projects (Zhang et al., 2018). In large projects, psychological studies showed that emotionally intelligent leaders engage in transformational leadership behaviour that ultimately contribute to project and organisational success (Potter et al., 2017). Transformational leadership is among the most researched subjects in leadership theory and implementation due to its substantiated positive impacts on performance under a variety of settings, and its contribution to the prediction of other leadership theories such as LMX (Megheirkouni & Mejheirkouni, 2020). In the scope of transformational and transactional leadership, the duality of leader-follower is mostly ignored. In large enterprises, project leaders may have subordinates (team members) line managers as well. This additional layer of leader-follower interaction is of paramount importance to situational leadership and has vital influence on organisational change management especially during crisis times (Li et al., 2019). Transformational leadership by senior managers is positively mediated by transformational project managers who induce autonomy in the project delivery structure and improves organisational learning (Vashdi et al., 2019; Xie, 2019). Such active participatory environment creates a desire for collaboration, innovation, expanded networking, elimination of outgroups, and buildup of team spirit in subordinates at all organisational levels (Mahmood et al., 2018). In other words, collaboration, innovation, complex problem-solving, intellectual stimulation, and networking cascade from the senior managers to the project leaders, and subsequently downwards to the team members. This also makes project teams more resilient to organisational crisis (Santos et al., 2016), creative, and adaptive to organisational and project changes at the team and individual dyad levels. On the other hand, the interaction between passive transactional leaders and their managers is deemed as direct and more formalized where cooperation is based on personal interests (Li et al., 2019). Such transactional self-oriented relationship thrives in stable business environments with clear project scope and path, and is driven by focus on own goals and welfare. Therefore, the presence of transactional leadership makes teams more prone to lack of performance, more vulnerable to organisational changes, and less capable of dealing with complexity.

Based on the previous discussion, a reasonable definition of what leadership is not, and what leadership is, can be furnished as follows. Leadership is not a person-centric static phenomenon that is related to a trait, quality, or behaviour taken in isolation from followers and the surround environment. Leadership is a dynamic multi-dimensional construct (Vaagaasar et al., 2020) that encompasses layers of intrinsic systemic complexity, relational process-based interactions among social actors, and diversity of contextual and situational organisational and external environmental factors (Ssegawa, 2015; Vashdi et al., 2019). Leadership has individual, shared, and institutional features, and cannot be isolated from management (Simić, 2020). Therefore, leadership is neither exclusive to a leader-follower interaction within a group nor to shared leadership within a group; but is manifested in the collective shared leadership of all engaged social actors (Vilas-Boas et al., 2018) and takes place at all organisational hierarchy levels.

Accordingly, a more realistic exploration and understanding of leadership in the project management domain, for the case of engineering and construction projects, shall be built on rigorous empirical examination and robust theoretical formulation that adequately encompasses the complexity and multi-dimensionality of leadership phenomenon. Obviously, this is cumbersome scholarly endeavour that shall incorporate cross-sectional and longitudinal examinations of the dynamic variations in leadership behaviour that are driven by the unique context, situations, complexity, and systems aspects of projects. The unique features and aspects of industries and projects naturally negate any risky scholarly research that attempts to generalize leadership phenomenon by merely analysing one industry or one project type. It is the intrinsically complex psychological and sociological fabric (Vilas-Boas et al., 2018) of leadership that arguably makes it contingent and exclusive to a specific set of relational and contextual variables. Additionally, the integration of the behavioural, psychological, sociological, and cognitive aspects of leadership can further help in the development and advancement leadership theories and practical implementation (Wu & Crocco, 2019).

From a systems thinking perspective, it is crucial to have a rigorous understanding and appreciation of the multi-directional interactions and communication between the parts of the system in order to achieve effective adaptive leadership; whether this is related to project leadership or to organisation-wide leadership.

A person-centric view of leadership negates the muti-dimensional and complexity of leadership phenomenon in organisations and projects; therefore, this view is irrefutably inadequate to understand leadership behaviour.

Leadership is a multi-dimensional construct that responds to different social actors who possess different powers and autonomy. Leadership is process-based with many input variables that can be grouped under leader-follower characteristics, organisational settings, and external environmental factors. The leadership process encompasses multi-directional and reciprocal relations, among the social actors, that are constantly in dynamic interaction with organisational artifacts and the external environments. Leadership behaviour is dynamic and varies over time according to the leader's and followers' response to organisational and environmental variables.

The complex multi-dimensionality of leadership phenomenon warrants application of systems thinking to understand how the various components of the systems, whether this is a project or an organisation, interact through feedback loops and ultimately affect the dominant leadership styles.

CHAPTER 3: RESEARCH METHODS

It is not an understatement to say that the transformation of modern organisations and society is driven by successful project delivery, and effective leadership is the heart of project delivery whether it is related to a societal-level transformational programme or building a bridge across a river to boost economy (Nieto-Rodriguez, 2021). Further, leadership is arguably deemed as the core quality of the 21st century project leaders (Madsen, 2015) particularly in the context of mega and complex engineering projects. The critical role of leadership even becomes more apparent in mega and giga projects which normally contributes a substantial fraction to a country's gross domestic product. Therefore, it is hardly a surprise to find a humongous amount of research which aims at unearthing the secretes of the ubiquitous leadership phenomenon and effective leadership in different human settings. Relatedly, the new norm of highly competitive markets, turbulent economies, sophisticated clients, complex stakeholders' environment, among others, puts more emphasis on unlocking the power of leadership to create competitive advantage (Appelbaum et al., 2015; Bossink, 2004; Chin, 2015; Nicolaides & McCallum, 2013). However, despite the presence of a plethora of studies on leadership, we are still witnessing an awfully stark trend in project failure, especially for the case of large and complex projects such as mega engineering projects. For instance, Flyvbjerg & Gardner (2023) studied 16,000 projects from a wide range of industries covering infrastructure, nuclear energy, power, tunnels, roads, dams, among others, and their research revealed a staggering failure rate of circa 99%. It is perplexing to see such a failure rate in spite of the huge number of published articles by professionals and scholars on what leadership is truly about, and how to effectively lead teams. Logically, the true question that would undoubtedly come to the mind is that are we still having a large knowledge gap in the understanding of leadership, particularly in the context of project management. And, what is required in terms of conceptualization and theoretical treatment to fill this knowledge gap. Based on literature review, it is fair to claim that leadership is a controversial and complex multi-dimensional social phenomenon. This is expectedly manifested in the numerous fragmented studies which often contain slippery definitions of leadership, conflicting outcomes, overlapped concepts, and bias in theoretical formulations (Awan & Mahmood, 2010; Day et al., 2014). The case of extant research on leadership in project management is no different whereas most of the scholarly research is analogously tackling leadership in project management as a two-dimensional problem in a four-dimensional reality, or alternatively speaking as looking at the tip of the iceberg only.

As such, contemporary research on leadership in project management suffers from several drawbacks, including a tendency to focus on leader-centric, unidirectional approaches and a failure to consider critical influencing factors such as the external business environment, the characteristics of followers, and the internal organisational settings. These factors are inextricably linked to leadership behaviour and have mutual effects on the leader's attitude and leadership styles, rendering leadership a multidimensional social phenomenon. Furthermore, existing research rarely addresses the mediating effect of project complexity on leadership attitude and styles, which can have direct consequences on leadership behaviour. Even studies that account for limited multidimensionality fail to address the dynamic nature of leadership. A successful leader must adapt to the complex landscape of multiple actors and influencing factors, which makes a static leadership style inadequate.

The aforesaid issues led to the definition of the research problem statement which is concerned with addressing the identified gaps project leadership literature, thus the study aims to examine leadership from a more holistic, multidimensional perspective, integrating the different actors and influencing factors into the conceptualization of dynamic leadership behaviour. Accordingly, the research aims at developing a dynamic and multidimensional leadership model that considers several input variables such as followers' characteristics, project complexity, internal organisational settings, and external business environment. The model is expected to serve as a practical tool to assist professionals optimise their leadership approach and improve project performance.

While there are project management leadership toolkits used by the professional project management community, many of these tools are oversimplistic and lack adequate scholarly research. This study emphasises a more robust and evidence-based leadership model that can provide a better understanding of leadership in project management.

This chapter presents the research approach, design, data collection tools and procedures, and data analysis techniques used in the study. It begins by describing the philosophical stance underlying the research approach and design and leads to the formulation of the theoretical framework. The chapter then explains the data collection process, including the sampling method and data collection tools used to collect primary quantitative and qualitative data. An elaboration on the theoretical framework is provided, including details on the definition of variables used to construct the framework.

Ethical considerations and risks are also outlined, with a description of how risks were mitigated and how anonymity and confidentiality were maintained throughout the data collection exercise. The chapter then describes the data collection procedures, and the analysis techniques used for the quantitative and qualitative parts of the study. The statistical analysis rationale and selected methods are clearly explained, along with the software used for quantitative and qualitative data analysis. The process of performing qualitative data analysis is thoroughly explained, including the manual and automated approaches to content and thematic analysis. The use of methodological triangulation to integrated data for the purpose of validating and verifying qualitative data analysis is then outlined.

3.1 Research Approach and Design

3.1.1 Philosophical Perspectives

The ontological and epistemological stances of this research are based on conceptualizing the reality of leadership phenomenon as relative, interpretive, and subjective, thereby perceiving the researcher as an object and subject simultaneously (Northouse, 2016; Schedlitzki & Edwards, 2014). The adopted philosophical perspectives emphasise that leadership cannot be foreseen from a positivist viewpoint (Clarke, 2012a) as an oversimplified construct of determined and static human behaviours and interactions (Campbell, 2007; Day et al., 2014). On the contrary, the contested and controversial causality relationships and interactions in leadership are process-based and rather more complex (Alvesson, 2017, Bass et al., 2003).

In other words, the research holds a constructivist standpoint whereby the meaning of social reality is constructed and interpreted by the social interactors, research respondents, who are intricately undergoing a continuous interplay of social transactions and cause-and-effect relationships (Thornhill et al., 2009). The world is seen through the eyes of the researcher and the research subjects as heterogenous and dynamic instead of being perceived as static and generalized (Berg & Karlsen, 2016). Relatedly, the adopted constructivism methodology aspires to increase the capacity of understanding and implementing leadership by scholars and practitioners in the field of engineering project management (Azcárate, 2012).

3.1.2 Theoretical Approach

While the research is primarily qualitative since it aims at exploring and explaining project leadership, it employs a hybrid deductive and inductive (abductive) approach by integrating qualitative and quantitative data using methodological triangulation. This abductive approach has arguably injected more rigor in the analysis to cope with the complexities of the research subject. Nevertheless, the inductive methodology carries larger weight and aims at generating theories or patterns from data rather than testing existing theories (Thornhill et al., 2009). The inductive research approach is data driven whereby a theoretical framework has been constructed upfront based on epistemological stances to ensure that the research is not conducted in an epistemological vacuum and is also grounded in existing knowledge, while allowing for flexibility (Braun & Clarke, 2006). Such flexibility has improved insights and discovery by uncovering emerging patterns and themes. The emerging themes played a pivotal role in the development of the practical leadership presented in Chapter 5. Subsequently, the theoretical framework was empirically validated using data integration and cross validation. In addition to the corroboration of the theoretical framework, which was constructed at the outset, the collected data was used to identify and examine any emerging causal relationships and patterns (Clarke, 2009).

3.1.3 Research Methodology

The research is predominantly qualitative since it emphasises on in-depth analysis (Bryman, 2012) to capture emerging patterns and themes in leadership behaviour, and to unveil any peculiar causal relationships of specific concern to the core research subject (Drouin et al., 2018; Yukl, 2010). Methodological triangulation was used to integrated data and validate qualitative findings through quantitative analysis of data obtained from the self-administrated questionnaire (Bansal et al., 2019).

Further, it is imperative to collect qualitative data to the level of saturation. This primarily concerns qualitative data collected through the semi-structured open-ended interviews to enable in-depth exploration and explanation of project leadership. This is essential to adequately understand the complexities of leader phenomenon in particular organisational settings (Bansal et al., 2019). Methodologically, the qualitative approach allows for testing of pre-existing knowledge by capturing emerging patterns in the human behaviour (Drouin et al., 2018; Yukl, 2010).

As such, it can be inferred that the research is characterized by scope since it aims at investigating leadership in project management at the macroscopic level. Additionally, it could be argued that the current research falls somewhere inside the spectrum of substantive and middle-range theories based on the adopted research approach (Thornhill et al., 2009).

3.1.4 Research Design

There are five types of research design that are normally applied in social research, namely: experimental design, case study, cross-sectional, longitudinal, and comparative design (Bryman, 2012). The case study and cross-sectional designs are implemented in this research. Scholars who implement case study design usually choose qualitative approaches such as observations and interviews. Relatedly, it is also quite common in case studies to utilise mixed research methods (Bryman, 2012). Therefore, the selection of a qualitative approach is suitable for the specific case in hand. The case study represents the community of project managers chosen from an international engineering firm with around 150 global offices in Middle East, Asia, Canada, North America, India, and Philippines. The availability of global offices offered a substantial advantage in terms of selecting a heterogenous study sample from different backgrounds and national cultures. Consequently, this provides an opportunity to cover an important dimension in leadership, namely national culture, which arguably influences leadership attitudes, styles, and behaviours, in addition to its direct correlation to how followers perceive leaders, and how they usually interact with different leadership styles.

The research is cross-sectional and thereby does not investigate the change in leadership behaviour over time. However, it could still be argued that the examination of leadership over the project's lifecycle inherently addresses leadership change over time. This approach allowed for investigating temporal variations and transitions in leadership attitudes and behaviours exhibited by the project managers (Carte et al., 2006; Jacques et al., 2008).

The case study firm employs a large population of project managers and directors, also cited as project leaders. Structurally, the organisation is divided into independent business units which perform in distinctive public and private market sectors including mobility, infrastructure, buildings, energy, and environmental protection, among others. Expectedly, the organisation is project-based where project managers play an essential role in business success through their leadership and technical competency in the effective delivery of projects. Project managers also contribute to sales by winning more engineering design and management commissions. The autonomy of project managers varies between strong and balanced in accordance with the organisational classification found in PMI (2017). Some project managers are qualified to run global projects with nationally diversified working groups and teams, especially in the case of outsourcing technical support from the offshore global design offices in India and Philippines. As such, an experienced project manager can have team members and subordinates (followers) from different national cultures and is expected to lead and manage virtual teams as well.

The selected organisation makes a compelling case study due to several reasons. First, the firm employs a large number of project managers from different seniority levels, hence offers a rich population for selecting the study sample. Second, the firm has been acquiring other engineering consultancy SMEs since year 2012 to diversity its market sectors, penetrate new markets, and to strengthen technical core competencies. On one hand, this has been forcing project managers, from the acquired firms, to adapt to a new organisational culture and management systems thereby stretching their leadership behaviour (Nicolaides & McCallum, 2013). On the other hand, project managers from the mother organisation are expected to meet the challenge of leading professionals exposed to different organisational cultures and project delivery customs (Appelbaum et al., 2015). Such specific situational setting, of cultural clashes, presents an intriguing case study to examine how leadership was put to the test, and how the situational transition between organisational cultures had influenced the leadership behaviour of project manager and the reciprocal interaction of the followers who hold different values and mind sets (Carte et al., 2006). Third, an effective and efficient decision-making process is one of the central aspects of successful leadership. In this respect, decisions related to the project's technical, operational, and management details normally follow a formalized procedure. Nevertheless, decisions in complex mega projects, with systems-like structure, can either be centralized or decentralized based on antecedent environmental conditions and project settings. Relatedly, decision-making can take the form of autocratic, democratic, or technocratic due to the unique nature of engineering projects, and sometimes because large projects involve global teams. This variation in operational decision-making presents a challenging case study from a leadership lens (Awan & Mahmood, 2010).

The research innovatively aims at offering valuable insights on the successful leadership attitudes and behaviour (Müller & Turner, 2010) in engineering project management, particularly in complex technical and human environments (Madsen, 2015). The research, through its intended holistic and multidimensional theoretical framework, seeks to understand the intricate mechanisms of leadership phenomenon beyond the oversimplistic models found in literature. However, even such ambitious objectives, with compelling strengths, come at a challenge in terms of research limitations as outlined hereafter.

Generally, the research strengths can be grouped under four categories. Firstly, the research employs a multi-dimensional theoretical framework (Mazzetto, 2019), which is predominantly reliant on qualitative approaches that offer extensive exploration and understanding of complex social interaction (Azcárate, 2012; Berg & Karlsen, 2016). Secondly, data integration offers the means to ensure trustworthiness of findings through cross validation of the data obtained from the in-depth interviews. Thirdly, the case study approach is focused on the target industry leading to highly relevant data (Barber & Warn, 2005). Relatedly, the selected case study organisation provides a large demographic population from which a diversified and homogenous study sample was chosen. Forth, programming tools, such as ANN and MDL, were used to intelligently analyse qualitative data in contrast to the majority of contemporary scholarly studies which use conventional software packages.

The lengthy interviews with the participants posed a challenge in terms of participant availability due to the normally busy schedule of senior project managers. Further, remote online interviews might be less efficient than face-to-face interviews which offer faster building of rapport with participants. In this respect, although it could be argued that modern video communication tools, such as Microsoft Teams and Zoom, can be used effectively utilised for virtual meetings, it is still believed that face-to-face meetings result in faster and more efficient human interaction.

Further, the research is cross-sectional only and did not investigate the change in leadership behaviour over an extended period of time, outside the project life cycle of interest. This approach allows for an alternative solution to investigate temporal changes and transitions in leadership behaviour (Carte et al., 2006) exhibited by the project managers (Jacques et al., 2008).

3.2 Research Population and Sample

The research population represents the project management community (PMC) at the case study engineering firm. The PMC is globally spread across different geographic regions including North America, Canada, Europe, UK, Australia, Asia, Middles East, India, Philippines, and Romania. The PMC facilitates knowledge and practice sharing between the different regions and includes circa 2,200 senior and middle experience project managers who work in various industries and market sectors such as urban infrastructure, nuclear power, renewable energy, environmental management, transportation, water structures, buildings, among others. Senior project managers not only lead projects in their respective regions but are often involved in global projects with teams recruited from all regions to fit the requirements and complexity of the projects. As such, the PMC offers a rich and representative population from which statistically representative samples can be chosen. The sample for the qualitative data was selected using non-probability purposive sampling based on prescribed criteria, whereas quantitative data was collected from a random sample of senior project managers. The qualitative sample selection criteria are based on a comprehensive multi-criterion matrix to ensure that the sample is adequate for capturing leadership practice from different geographic regions and market sectors as shown in Table 3.1.

Table 3.1

Sample selection criteria

Type of Data	Sampling Method	Selection Criteria
Quantitative Tool: Survey via Self-Administrated Questionnaire	Random sampling. Senior project managers in different regions Sample Size: 300 ID: Sample A	Project manager experience: greater than 5 years Minimum no. of managed projects: 5 Team size for each project: above 3 Project complexity: multi-disciplinary Industry, Market Sector: All sectors
Qualitative Tool: Structured and Semi-Structured Interviews	Non-probability Purposive sampling. Participants were selected to cover gender, western and eastern regions, in addition to the selection criteria shown to the right Sample Size: 30 ID: Sample B	Project manager experience: greater than 15 years Minimum number of managed projects: 5 Project manager category: 4 or 5 Team size for each project: above 10 Project complexity: multi-disciplinary, value greater than USD 1.0 and 50.0million for design and construction projects, respectively Industry, Market Sector: Infrastructure, transportation, buildings, environmental management, and power

As shown in Table 3.1, the selection criteria for the quantitative date sample (Sample A) cover years of experience, minimum number of projects managed by the participant, market sector, team size (e.g. number of team members), and project complexity. The selection criteria of the qualitative data sample (Sample B) are similar to those pertaining to Sample A with two additional criteria related to project manager category and the project's monetary value. The project manager category was selected to ensure that senior highly experienced project managers are selected for the interviews. In this respect, the PMC implements categories from 1 to 5, with 4 and 5 assigned to project leaders with global experience and large teams. The multi-criteria matrix was shared with the global project management director who assisted in the selection of suitable candidates for the research samples. The quantitative data collection sample (Sample A) included 300 participants from different geographies. Sample B included 30 project leaders who were carefully picked up from Sample A (Sample A is considered as population of Sample B). The statistical reasoning behind the sample sizing is described hereinafter.

Non-probability purposive sampling was employed for the selection of the interview participants to obtain qualitative data as the research is primarily qualitative in nature and seeks in-depth investigation of leadership. The aforesaid method of sampling is widely used in qualitative studies that involve selection of participants based on specific pre-determined criteria to fit the research's objectives and questions (Palinkas et al., 2015). Basically, it allows the researcher to choose participants who are likely to contribute relevant and rich data that are specific to the study subject, in addition to ensuring that the research sample is adequately diverse to capture different experiences and perspectives by the participants (Guest et al., 2012).

In the context of leadership in project management, non-probabilistic purposive criteria sampling can be particularly useful as it allows the selection of participants who have relevant experience and knowledge in the field, such as project managers, and who can provide valuable insights into the leadership practices that are effective in this context. Furthermore, purposive sampling can help to ensure that the sample includes participants from a variety of project types and industries, which can be important for capturing the breadth of leadership practices across different contexts. This was guaranteed in the study by choosing participants from different regions to cover western and eastern cultures.

Sometimes non-probability sampling techniques might not allow for statistical generalisation of the findings; however, they can provide in-depth insights into the experiences and perspectives of participants and generate rich data for qualitative analysis (Creswell & Poth, 2018). Therefore, due care must be exercised when considering the limitations of this sampling technique, such as potential biases in participant selection and the difficulty of ensuring sample representativeness (Palinkas et al., 2015).

To overcome the challenges of a statistically representative sample, it is important to consider the characteristics of the project management industry. In this respect, while the PMC may have unique attributes, it could be argued that the PMC is representative of the AEC industry as a whole if it shares key features with other project management communities such as diversity of market sectors, engineering practices, project delivery methods, and nature of clients (i.e. private and public sectors). According to Shenhar and Dvir (2018), project management is a discipline that is applied across a wide range of industries, including construction, information technology, healthcare, and finance, among others. As such, the fact that the PMC manages projects in various market sectors suggests that it could be representative of the industry as a whole.

Another factor to consider is the geographic spread of the PMC. The fact that the community is spread across different regions, including North America, Canada, Europe, UK, Asia, Australia, and Middle East, and offshore offices in Philippines and India suggests that it has a global reach; and is therefore representative of the AEC industry on a global scale. This is supported by the fact that the project management discipline is practiced worldwide and has become increasingly globalised in recent years (Thomas & Mullaly, 2008).

Additionally, the fact that many project managers in the PMC community may have worked at other international engineering firms before joining the case study firm further supports the argument that they collectively represent the industry. According to Crawford et al. (2014), project managers often move between organisations and industries, acquiring new skills and experiences along the way. This suggests that the PMC of interest is likely to have a diverse range of backgrounds and experiences, making it more representative. In their study on the global project management profession, PwC (2012) found that the skills and knowledge required to manage projects effectively are largely transferable across different industries and sectors, and that project managers often move between organisations and industries throughout their careers. This suggests that the PMC in a large global engineering firm is likely to have similar skills and knowledge as that of project managers in other industries, hence making the PMC a reasonable representation project management communities across the AEC industry.

Similarly, in their study on project management competencies in the aerospace and defence industry, Hovden and Flannes (2013) found that many of the competencies required for project management success, such as leadership, communication, and risk management, are transferable across industries. This further supports the idea that project managers in a PMC can be seen as representative of the broader project management industry.

Turner and Müller (2014) studied the evolution of project management and noted that it has become a discipline in its own right, with a common language, set of tools and techniques, and knowledge base that is transferable across industries and sectors. They argue that this has contributed to the professionalization of project management and its recognition as a distinct field of practice. This also can be witness by the universally accepted project management, and engineering practices, which makes the profession more standardized and transferable.

In conclusion, the PMC in the selected engineering firm can to some extent be deemed as a statistically representative population of the AEC industry as a whole based on its diversity of projects and industries, global reach, and the likelihood that many of its members have worked at other international engineering firms. This suggests that a sample taken from this population can also be statistically representative of AEC industry as described below.

To ensure that the samples of project managers are statistically representative, it is essential to apply appropriate sampling techniques that guarantee a normally distributed representation of the population. Although this is normally achieved through random sampling, the case of this research is different thereby applying non-probabilistic purposive sampling while ensuring the samples capture the essence of the industry. Expectedly, it was not an onerous task to select participants for qualitative data collection due to the reasonable sample size of 30 project managers (Sample B). Comparatively, Sample A included circa 300 project managers; therefore, random sampling was applied to ensure a statistically significant coverage of all geographic regions and market sectors.

Statistical formulas employing margin of error and confidence level were used to determine if the sample size of 300 is statistically significant for a population size of 2,200. Most importantly, a fraction of the PMC was used in the formulas after filtering the population part that matched the selection criteria. For instance, interns, junior project managers, project coordinators, and staff who are not formally classified as project managers, were excluded from the population. Consequently, the compliant population size ultimately became around 1,500.

The size of a statistically representative sample, for quantitative data collection, was calculated using the formula below (Kaplan & Kornblum, 2014) to achieve a desired margin of error and level of confidence.

$$n = \frac{Z^2 P(1-P)}{E^2}$$

Where:

n = sample size

Z = confidence level (1.96 for 95% confidence level)

p = estimated population proportion (1500/2200 = 0.6818)

E = margin of error (5%).

Accordingly, the calculated sample size is circa 333 which is reasonably close to the actual sample size of circa 300, particularly when knowing that statistical significance depends on several factors such as the level of confidence desired, the variability of the population, and the effect size. In some cases, a smaller sample size may be sufficient to achieve statistical significance, while in other cases a larger sample size may be necessary.

The use of this formula is based on statistical principles and assumptions, and its validity depends on several factors, including the desired level of precision, the population size, and the distribution of the population. The formula assumes a normal distribution of the population, and its accuracy increases as the sample size increases. It also assumes a simple random sampling method, which is not always feasible or practical in real-world situations (Creswell & Creswell, 2018). In cases where a non-probability purposive sampling method is used, a smaller sample size may be sufficient. The actual sample size required depends on several factors such as the variability of the population, the level of precision desired, and the statistical power required (Creswell & Creswell, 2018). Krejcie and Morgan (1970) provide useful guidelines for determining sample size in research, suggesting that a minimum sample size of 100 is necessary for most research purposes, and that a sample size of 300 is considered large enough for most purposes. Furthermore, Kline (2014) suggests that sample size should be determined based on the statistical power of the study, which is the probability of detecting a true effect if it exists.

Overall, while there are various formulas and guidelines for determining sample size, it is important to consider the specific context and research when determining the appropriate sample size for a survey.

In any case, it is important to acknowledge the limitations of a sample size that may be smaller than the recommended minimum and to interpret the results with caution. Nevertheless, the findings may still provide valuable insights but may not be generalizable to the entire population with the same level of confidence as a larger sample size.

In the case of the project management community of an international engineering firm, a sample size of 300 project managers was deemed sufficient. While this is lower than the calculated sample size of 333, it still provides a reasonable level of precision and statistical power, especially when combined with other data collection methods such as interviews and case studies (Bryman, 2012).

Furthermore, as noted by Creswell and Creswell (2018), the quality of the sample is more important than its size. As such, a well-designed and executed sample of 300 project managers from the PMC, with representation from different geographies and industries, can still be statistically representative and provide valuable insights (Krog & Govender, 2015; Northouse, 2016).

As mentioned earlier, the case of selecting participants for qualitative data collection (Sample B) differed from that for Sample A in the sense that it entirely relied on non-probabilistic purposive sampling, and careful selection of individual participants (i.e. only senior project managers, category 4 and 5) to ensure a representative coverage of gender, geography, project size and complexity, and market sectors. In comparison with other studies, Cullen and Leavy (2017) undertook exploratory inductive research using a similar sample size of 30 participants from the project management domain.

3.3 Material & Instrumentation of Research Tools

Data collection was performed using quantitative and qualitative data collection tools. Quantitative data was collected from Sample A (300 participants) using a self-administrated questionnaire (SAQ) which comprised forty 5-point Likert scale questions (refer to Appendix 1). Muller and Turner (2010) studied leadership attitudes that impact project success; and used a similar quantitative approach using ANOVA analysis on 400 responses collected from SAQs. The survey questionnaire was distributed to the participants through an internal group email facilitated by the global project management director. The SAQ questions were developed through a mapping process to the theoretical construct. Furthermore, the SAQ borrowed from a few well-established instruments (Ahmed & Philbin, 2020) used in scholarly research on leadership theory, as mentioned in the literature review in Chapter 2, Section 1, including the Leader Dimension Questionnaire (LDQ) and the Multifactor Leadership Questionnaire (MLQ).

The LDQ is a widely used instrument in leadership research that measures leadership styles based on the situational leadership theory. The LDQ has been used in various studies to evaluate leadership behaviours and effectiveness. The LDQ consists of 20 items that measure these dimensions, with 10 items for each dimension. Respondents rate their leaders on a five-point Likert scale for each item. The LDQ has been used in various studies to assess leadership behaviour, such as a study by Wong and Davey (2007) that explored the relationship between transformational leadership and organisational citizenship behaviour in a sample of Australian employees. The researchers used the LDQ to measure transformational leadership, with a Cronbach's alpha coefficient of 0.90, indicating high internal consistency of the items. The LDQ measures nine leadership dimensions based on four situational leadership styles: Directing, Coaching, Supporting, and Delegating.

The Multifactor Leadership Questionnaire (MLQ) is a widely used survey instrument for assessing leadership style and effectiveness and was updated since its inception in 1981. The MLQ measures leadership behaviours and attitudes across nine different dimensions, including transformational leadership, transactional leadership, and laissez-faire leadership. The questionnaire is typically self-administered and consists of a series of statements that the respondent rates on a scale of 0 to 4. The MLQ has been used in a variety of settings, including business, government, healthcare, and education, and has been translated into multiple languages. Its reliability and validity have been well-established through numerous studies and meta-analyses (Breevaart et al., 2014; Gumusluoglu & Ilsev, 2009; Wang et al., 2014).

On the other hand, some of the adopted instruments were not only utilised to build the SAQ but were also used as assistance tools to examine and study patterns of the predicted variable, namely: the dynamic situational leadership behaviour (i.e. leadership styles).

For example, the Leadership Behaviour Questionnaire (LBDQ-XII) developed by Stogdill in 1963 and the Leadership Grid devised by Blake and Mouton in 1985 were adopted to facilitate the identification and categorization of the dominant leadership styles exhibited by the participants over the lifecycle of their projects (Northouse, 2016). The Leadership Grid (9-point scale) classifies a leadership style as a combination of task and people orientations.

However, due to the innovative nature of the current study, which is exemplified in the multi-dimensionality, even the most renowned tools could not be fully utilised in their entirety since they were limited to some aspects or theories of leadership (e.g. transformational leadership only).

A pilot study was conducted by distributing the SAQ to selected senior participants and receiving feedback on the type and scope of questions therein, in addition to any suggestions for improving the clarity of the questions (Alvesson, 2017). A pilot test is a crucial step to ensure that the questionnaire is effective, clear, and relevant to the research questions. It also helps to identify any issues with the survey instrument and improve it before implementing it on a larger scale. The pilot test was conducted as follows.

- A group of 20 senior project managers was selected as representative sample of the target Sample A. This group is similar in characteristics to the actual participants in Sample A.
- The questionnaire was administered to the pilot group for responses and to solicit feedback on the clarity, comprehensiveness, and relevance of the questions.
- Responses were qualitatively and statistically analysed (sensible check) to determine any inconsistencies or anomalies in the responses.
- Generally, there was unanimity among the participants about the clarity and seamless logical flow of questions in the questionnaire. Nevertheless, some questions were slightly revised and improved based on feedback from participants (Chin, 2015).
- Use the feedback to modify and improve the questionnaire, if needed.

The Cronbach's alpha coefficient (α) was used to measure the internal consistency of the questionnaire's items based on the responses from the pilot participants (i.e. 20 participants $\times$ 40 questions = 800 responses). The formula used to calculate the Cronbach's alpha coefficient is shown below. The mean score of each question, variance, total variance, and covariance for each pair of questions were calculated to estimate α coefficient. The calculation was undertaken using statistical modules from the programming language Python.

$$\alpha = \frac{N}{N-1}\left(1 - \frac{\sum item\ variance}{Total\ variance}\right)$$

where N is the number of items (i.e. 40 questions).

Accordingly, a Cronbach's alpha value of 0.78 was obtained which is above 0.70; hence is considered acceptable for social research (Nunnally, 1978). A study conducted by Giri and Kumar (2014) aimed to develop and validate a scale for measuring the perception of project managers towards knowledge management in Indian software firms. They collected data from 200 project managers using a questionnaire with 30 items. The Cronbach's alpha coefficient for the overall scale was calculated to be 0.93, indicating a high level of internal consistency among the items.

Qualitative data was systematically collected using one-to-one interviews (Bennett, 2009) with 30 participants from Sample B who were prudently selected in accordance with the selection criteria described in Section 3. Each interview consisted of thirteen structured questions with a combination of semi-structured open-ended sub-questions (refer to Appendix 2) to pursue in-depth information, and to seek hidden patterns or themes in relation to leadership styles exhibited by the interview participants (senior project managers). As mentioned earlier, this research is predominantly qualitative in nature, whereby quantitative data are utilised as a support tool to validate and verify the outcome from the qualitative data collection exercise (Bansal et al., 2019).

The Project Success Assessment Questionnaire (PSAQ) was consulted during the interviews to measure project success and to semantically correlate success to leadership attributes and behaviour. The PSAQ consists of 34 items that are grouped into six dimensions of project success: project planning, project execution, project control, project team, project stakeholders, and project environment. The PSAQ uses a 5-point

Likert scale to rate the level of agreement with each item. The total score of PSAQ ranges from 34 to 170, where higher scores indicate higher levels of project success.

The PSAQ has been used in various research studies to assess the success of projects in different industries and contexts. For instance, Al-Muharjan and Al-Ghonamy (2014) used PSAQ to evaluate the success of construction projects in Saudi Arabia. Similarly, Alshawi and Alalwan (2019) used PSAQ to assess the success of information technology projects in Bahrain. The results of these studies demonstrated that PSAQ is a reliable and valid tool for assessing the success of projects in various contexts.

The Complexity Assessment Questionnaire (PMI, 2014) which consists of 48 questions was used to measure the complexity of projects narrated in the qualitative interviews.

Assessing the complexity of an engineering project is essential for planning and executing the project successfully. Various assessment tools are used by the engineering community to evaluate the complexity of a project. These tools help engineers to identify the potential risks and challenges of a project and develop strategies to mitigate them. In this answer, we will discuss some of the commonly used assessment tools and their applications.

One of the most widely used tools for assessing the complexity of an engineering project is the Work Breakdown Structure (WBS). WBS is a hierarchical method of breaking down a complex project into smaller, more manageable components. This tool helps engineers to identify the critical components of a project and prioritize their efforts accordingly (Pinto & Slevin, 1988).

Another useful tool for assessing project complexity is the Critical Path Method (CPM). CPM is a project management technique that identifies the critical path or the sequence of tasks that must be completed on time to ensure the project's success. CPM helps engineers to understand the project's timeline, dependencies, and potential bottlenecks (Kerzner, 2013).

Engineering Complexity Scale (ECS) is another tool used to assess the complexity of a project. ECS is a quantitative approach that uses a set of metrics, such as project size, technological novelty, and organisational complexity, to calculate a complexity score for a project (Browning & Ramasesh, 2015). This tool helps engineers to identify the risks and challenges associated with a project and develop appropriate strategies to mitigate them.

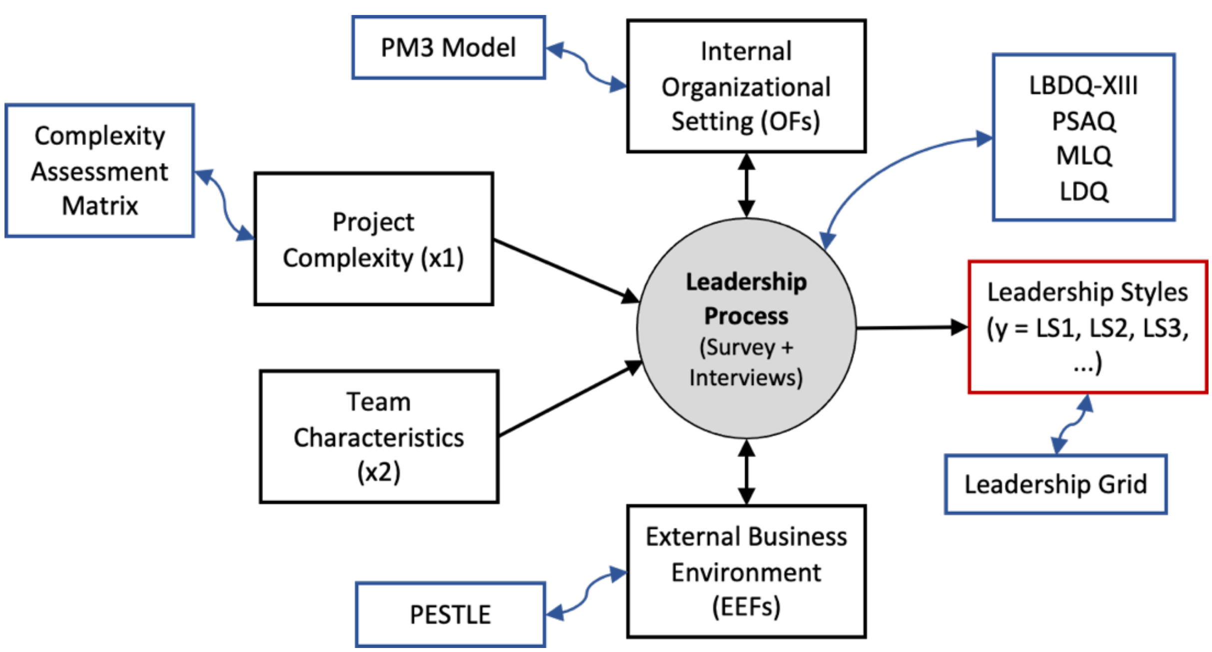
Apart from these tools, various other methods are used to assess the complexity of engineering projects, such as the Systematic Hierarchical Approach for Resilient Process Screening (SHARPS), which is used to identify the critical components of a project and prioritise their efforts (Borzooei et al. , 2019).

Assessing the complexity of an engineering project is crucial for successful project planning and execution. Various assessment tools, such as WBS, CPM, ECS, and SHARPS, are used by the engineering community to evaluate the complexity of a project and identify the potential risks and challenges associated with it. By utilising these tools, engineers can develop appropriate strategies to mitigate the risks and ensure project success.

Internal organisational settings (OFs) include three components, namely: (a) project management structure (PMI, 2017) characterized by weak, balanced, or strong matrix, (b) project management competence measured by the Project Management Maturity Model 7 (PM3) found in PMBok (PMI, 2017), and (c) team culture/character (e.g. skills, social culture, etc). External environmental factors, or alternatively known as enterprise environmental factors (EEFs), are multi-fold and cover stakeholder such as customers, government agencies, etc, and political, economic, social, technological, legislative, and environment factors (PESTLE). Figure 1 below depicts the instruments (shown in blue box) adopted in the study and the allocation of such instruments to the variables in the theoretical framework.

Figure 3.1

Research instruments mapped to the conceptual framework



3.4 Study Procedures and Ethical Assurance

This section outlines the procedures used in the preparation and execution of data collection, and describes the robust measures taken to ensure ethically sound dissertation research.

3.4.1 Study Procedures

As mentioned earlier, participants were recruited through email invitations. The email invitation explained the purpose of the research and type of collected data (Grinyer, 2013). Informed Consent Forms were enclosed in the emails sent to interview participants. The consent form included information about the study's purpose, what participation will involve, the duration of the study, and the expected benefits and risks of participation (Polit & Beck, 2017). The consent form also included a statement about voluntary participation, and that participants can withdraw from the study at any time without any negative consequences.

Subsequently, the data collection tools were distributed to the participants after obtaining necessary approvals and consents. The survey questionnaire was distributed to Sample A through the organisation’s intranet in an embedded survey in order to directly import the responses from the questionnaire into Microsoft Excel. The survey group message included a brief about the survey and research subject in line with the information given in the questionnaire itself. Participants were selected based on non-probabilistic purposive sampling based on a predetermined criteria related to experience in project management (Creswell & Creswell, 2017).

Afterwards, the Interview Schedule was sent to the interview participants, and included a guide on the interview procedure and protocols. The interview included questions about experience, previously managed projects, among others, to elicit responses and categorize participants based on gender, geography, and type of market sector (Braun & Clarke, 2014). The interview schedule was piloted to ensure that the questions are clear and relevant to the research questions.

Upon completion of preparatory work, the interviews were remotely conducted via Microsoft Teams, based on the preference of the participants (Kanerva & Ylöstalo, 2014). Before the interview, the researcher reminded the participants about the purpose of the research in an attempt to build rapport and pave the way for smooth and effective interview sessions. The researcher explained the confidentiality and anonymity of the participants, and their right to withdraw from the interview at any time without any negative consequences. The interviews began with the structured questions and then proceeded with semi-structured sub-questions based on the level of interaction with the participants. The order and type of sub-questions was relatively flexible and depended on each respondent (University of Leicester, 2011). The different experiences, reaction to project environments, and forms of leadership behaviour revealed during the interviews dictated further sub-questions to solicit in-depth information about the participants' perception of leadership in project management (Clarke, 2012b). The researcher carefully used probing during the interviews in order to avoid bias and influence on the participants' responses in an objective and transparent dialogue, without prejudice. The average duration of the interview was approximately 40 minutes, while some interviews exceeded the average by 15 minutes.

The interviews were automatically audio-recorded and transcribed via Microsoft Teams, and then analysed using thematic analysis (Neergaard et al., 2013). Although

Teams offers a feature of transcribing meetings, the transcripts were manually reviewed and cleaned up to avoid any loss of information that might had happened during the automatic transcription. The data collected were solely for research purposes and were securely archived. Initially, it was envisaged to use a password-protected military-grade encryption for audio-recorded interviews; however, this was no longer needed since Microsoft Teams recordings are encrypted and cannot be accessed without a password.

Each interview file was given a unique designation in accordance with the following naming convention: ID-Gender-Region-Sector-Project Type (each field consists of two spaces). Examples of file naming are given below.

Example 1: 09-ML-NA-IF-CN (interview no. 9, Male, North America, Infrastructure, construction).

Example 2 : 23-FL-ME-BL-DE (interview no. 23, Female, Middle East, Buildings, design).

The survey and interviews protocols ensured that ethical considerations are put in place to protect the participants' rights, privacy, and dignity, and that the research generates reliable and valid data that can be used to inform leadership practices in project management.

3.4.2 Ethical Assurance

Ethical assurance measures were undertaken throughout the dissertation Stages 1 to 3 to ensure best-in-class scholarly research ethical conduct, compliance with UniCAF University ethical requirements, confidentiality of information, protection of participants' privacy, security of data, and mitigation of ethics risks as much as practicable. Provisional ethical approval was obtained in Stage 1, and final UREC ethical approval was obtained in Stage 3 on 22nd February 2023 with a decision “A. Approved without revisions or comments”. Generally, the research has negligible risk to individual participants, Company XYZ from which participants were recruited, and does not have any risk to the community. In this respect, the research did not involve minority groups, sensitive or fragile groups, people with disabilities, and does not engage with any act, whether implicit or explicit, that might infer or imply discrimination or gender inequality. Additionally, approval by the Gatekeeper was obtained to facilitate the recruitment of survey and interview participants, to distribute the survey questionnaire to Sample A, and to conduct virtual interviews with participants in Sample B. Likewise, an informed consent (IC), with proper disclaimers, was shared with the interview participants to describe the purpose of the research, its methods, and tools, expected outcomes, and included assurance statements regarding confidentiality of information. The IC form clearly outlined the research aspects so that the respondents become fully aware about their engagement and also feel comfortable about the security and confidentiality of data.

As a researcher, ensuring ethical assurance in qualitative research is of paramount importance to protect the participants' rights, privacy, and dignity.

The first ethical consideration is the informed consent. Before conducting any interviews, the participants were informed about the purpose of the research, their rights, and the procedures involved in the study (Creswell & Creswell, 2017). The participants were given sufficient time to review the consent form and ask any questions before giving their consent to participate in the study. Moreover, the consent form explicitly stated the confidentiality and anonymity of the participants, and their right to withdraw from the study at any time without any negative consequences (Polit & Beck, 2017).

Secondly, to ensure privacy and confidentiality, all participants were assigned a unique identification code. The identification codes were used in place of the participants' names in all transcripts, notes, and research reports to ensure anonymity (Braun & Clarke, 2014). Only the author of this research had access to the data (Grinyer, 2013). All audio recordings were securely stored, and password protected in Microsoft Teams, on a password-protected computer. No hardcopies were produced from the transcripts to avoid accidental access to outsiders.

Thirdly, ethical considerations for remote interviews were put in place to ensure that the participants' privacy and confidentiality were protected. All remote interviews were conducted through Microsoft Teams, which has end-to-end encryption to ensure the confidentiality of the data transmitted (Kanerva & Ylöstalo, 2014). Before the interview, participants were instructed to find a private and secure location where they could speak freely without interruptions or distractions. All data collected were used solely for the purpose of the research and will be securely destroyed after the research is completed.

Lastly, ethical considerations were put in place to ensure that the participants' rights were respected. Throughout the research process, the participants were treated with respect and dignity. The researcher avoided any questions that could be potentially offensive or harmful to the participants (Neergaard et al., 2013). For instance, there were no questions or probes that aimed at judging the project manager’s leadership skills and performance on the projects. Participants were assured that their participation was voluntary, and they had the right to withdraw at any time without any negative consequences.

In conclusion, ethical assurance measures were carefully undertaken in this study to protect participants and collected data, and to generate reliable and valid data that can be used to inform leadership practices in project management.

3.5 Data Collection and Analysis

This section describes the data analysis techniques associated with the quantitative and qualitative data collection tools and presents some examples from the data analysis exercise.

3.5.1 Quantitative Data Collection and Analysis

Quantitative data were collected using a SAQ which employs a 5-point Likert scale to measure the respondents' attitudes towards leadership, with 1 representing strongly disagree and 5 representing strongly agree. The questionnaire also includes categorical variables to collect demographic information about the respondents, such as gender, age, and years of experience in engineering project management. The SAQ was distributed to Sample A (circa 300 project managers) and a response rate of nearly 43% was obtained (128 responses). Table 3.2 below summarises the responses from the survey questionnaire based on gender and region (i.e. two important parameters in the analysis). There was a total of 106 male respondents and 20 female respondents. Male respondents were 33% and 67% split between western and eastern geographies, respectively. Comparatively, the female respondents were distributed at 85% and 15% between western and eastern geographies, which is an indication of the low number of female project managers in the eastern geographies.

Table 3.2

Summary of survey questionnaire responses

Male	84%	by Region
West	35	33%
East	71	67%
	106	

Female	16%	by Region
West	17	85%
East	3	15%
	20	

When analysing data collected using a 5-point Likert self-administered questionnaire, the most suitable statistical analysis methods depend on the specific research questions, the nature of the data, and the research objectives (i.e. measure variables or study a phenomenon in depth).

Generally, the quantitative analysis methods comprised descriptive statistics, correlation analysis, and inferential analysis (refer to Chapter 4), so it can be deemed that the level of quantitative analysis is reasonably commensurate with objective of supporting the qualitative findings. In this respect, validation using methodological triangulation was used rather than integration using mixed methods where for the latter both qualitative and quantitative methods bear equal weights. The quantitative analysis presented hereafter is not detailed but also is far from being rudimentary. The analysis employed statistical techniques including descriptive statistics, ANOVA, frequency analysis, percentile distribution, correlation analysis for pairs of questions, correlation matrix/heat maps, F-test, U-test, p-value, and 95% confidence intervals. Additionally, a variety of graphical illustrations and tabulated results were utilised to offer a good explanation of the results and relationships. Worth mentioning, correlation analysis was not used to test hypotheses, or to measure the direction of relationships (e.g. negative, positive, but was rather utilised to validate the plausibility of the pre-existing foundational knowledge that is encapsulated in the theoretical framework.

The following commonly used statistical methods for analysing Likert scale data were implemented to different extents (Sullivan & Artino, 2013).

1. Descriptive statistics: This includes measures such as means, standard deviations, frequencies, and percentages to describe the central tendency, variability, and distribution of the data. For instance, responses were examined against gender (male vs. female) and geography (west vs. east) to investigate the impact of gender and national culture on situational leadership behaviour. Tabulated and graphic representations of response frequencies were employed to validate and corroborate the outcome from the qualitative analysis. For example, Figure 3.2 (a,b) illustrates frequency analysis for the survey questions pertaining to situational leadership, and number of responses to Q24 by gender. Results and interpretations of frequency analysis, among others, are discussed in Chapter 4.

Figure 3.2 (a)

Frequency analysis of situational leadership questions

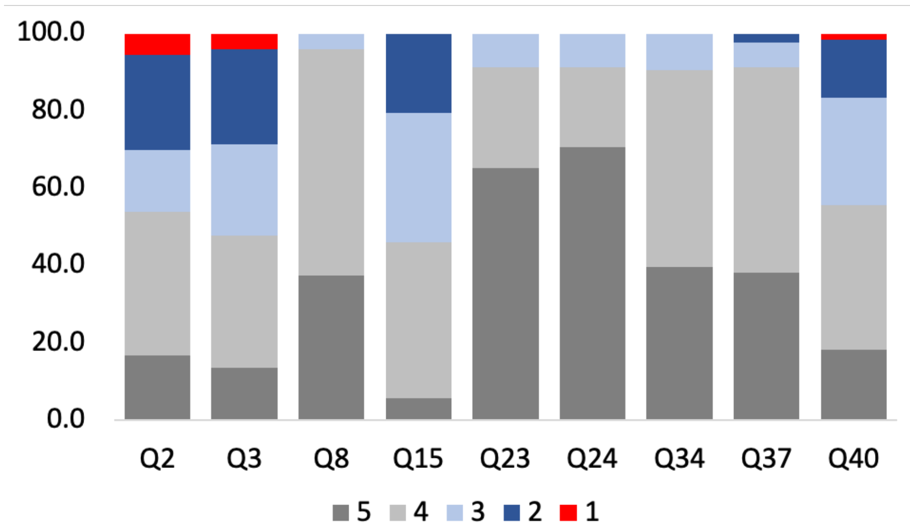
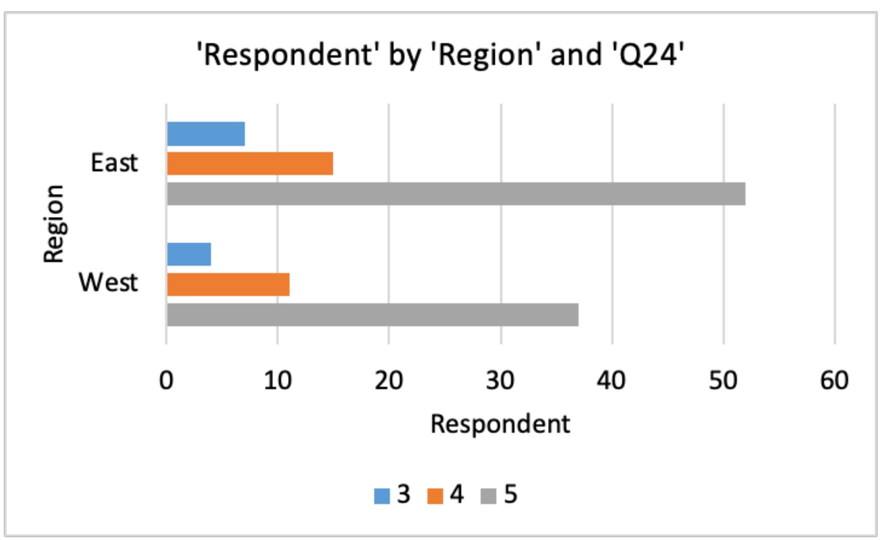


Figure 3.2 (b)

Frequency analysis of situational leadership questions



2. Inferential statistics: This includes statistical tests such as t-test, Chi Square test, ANOVA, and regression analysis to determine whether there are significant differences between groups or relationships between theoretical framework variables. For instance, the correlation between pairs of survey questions was established to facilitate further grouping of questions and subsequent mapping to the theoretical framework (Jasemi & Zare, 2015; Maqsood & Sadiq, 2018).

In analysing the proposed theoretical framework, regression analysis and Chi Square ($\chi 2$) test are two statistical methods that can be used to investigate the relationship between the independent variables and the dependent variable. Regression analysis is a statistical technique that is used to explore the relationship between one dependent variable and one or more independent variables. In this case, regression analysis can be used to examine the relationship between the leadership styles adopted by a project manager and the independent variables of project complexity, team characteristics, external business environment, and internal organisational setting, the latter two variables being assumed as mediating variables. The results from regression analysis can indicate the significant effects of each independent variable on the dependent variable.

For instance, in a study conducted by Maqsood and Sadiq (2018), the authors examined the relationship between leadership styles and project success in the construction industry of Pakistan. The study employed regression analysis to investigate the effect of leadership styles on project success while controlling for the influence of project complexity, team characteristics, and organisational culture. The results of the study indicated that project complexity and organisational culture significantly influenced the choice of leadership style for project managers.

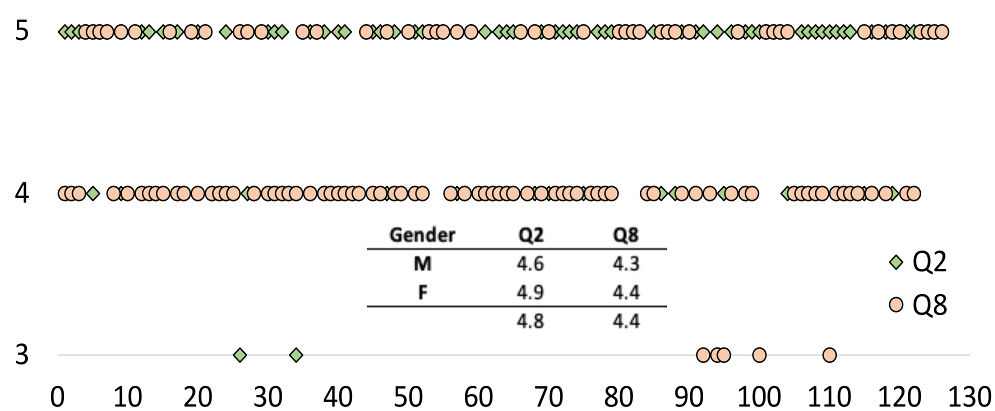
Similarly, chi-square test can also be used to analyse the relationship between two categorical variables, such as leadership style and team characteristics (Huang et al., 2020). Chi-square test is a non-parametric statistical test that measures the association between two categorical variables by comparing observed frequencies with expected frequencies. The test is based on the assumption that the data is randomly sampled from a population with a known distribution (Ghasemi & Zahediasl, 2012). The test calculates a Chi Square statistic, which is the sum of the squared differences between the observed and expected frequencies divided by the expected frequency. The Chi Square test is used to determine whether the observed data is significantly different from the expected data, based on a specified level of significance and the degrees of freedom (Field, 2018). As such, Chi Square was used to analyse the survey questionnaire that employs a 5-point Likert scale and categorical variables related to leadership in engineering project management (Huang et al., 2020).

In context of this study, chi-square test was used to investigate whether there is a significant association between the leadership styles adopted by project managers in response to variables such as team characteristics. For instance, Jasemi and Zare (2015) investigated the factors affecting project success in Iranian construction projects. Their study employed chi-square test to investigate the relationship between project success and team characteristics such as communication, cooperation, and trust. The results of the study indicated that effective communication and trust among team members significantly influenced project success.

Figure 3.3 illustrates an example on the distribution of the scoring of questions Q2 and Q8 in the survey. The chart demonstrates stark congruence between the responses to Q2 and Q8 in which are both related to the preference of switching between leadership styles to cope with situational factors such as project complexity. The absolute value of the Pearson correlation coefficient for such, and other similar, pair of questions was calculated at circa 0.95 as discussed in Chapter 4.

Figure 3.3

Distribution of likert scale scores for survey questions Q2 and Q8 (average scores are shown against gender)



3. Structural equation modelling (SEM): SEM can be used to test theoretical models based on Likert scale data, and was simplistically employed to examine the complex multi-faceted correlation (αi) between the variables, and possibly the mediating variables, including causal relationships (Kong et al., 2020). Most importantly, the application of SEM will be overarching and will borrow from inferential

and relational data analysis due to the complexity of the theoretical framework and the myriads of plausible interlinks between the theoretical construct's elements.

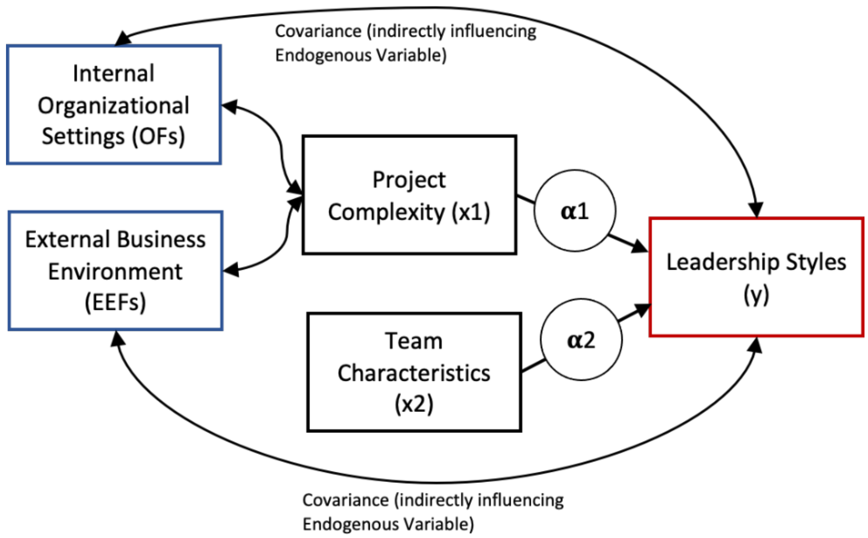
Simple SEM path analysis was used to measure the endogenous variable, namely leadership behaviour which is manifested in the project manager's dynamic leadership styles (Rahman et al., 2018). The diagram shown in Figure 3.4 depicts how exogenous variables (xi) are likely to influence the endogenous variable (y). Relatedly, partial least squares structural equation modelling (PLS-SEM) can be used for further research to analyse the relationships between latent variables in a data set. It is a type of structural equation modelling (SEM) that is particularly useful when the sample size is small, the data is non-normal, or the relationships between variables are complex.

In PLS-SEM, the focus is on maximizing the explained variance of the endogenous variables, which are the variables that are being predicted by the model. The technique works by constructing a set of latent variables, called constructs, that represent the underlying dimensions of the observed variables. These constructs are estimated using a series of regression equations, and the relationships between the constructs are represented by a path model.

One of the advantages of PLS-SEM is that it can handle both reflective and formative constructs. Reflective constructs are measured by multiple indicators that are highly correlated with each other, while formative constructs are measured by indicators that are distinct and contribute to the definition of the construct. PLS-SEM can also handle complex models with many latent variables and multiple paths. Some of the scholarly research that was consulted to build the SEM model is described hereinafter.

Figure 3.4

Implemented SEM path analysis (correlation) diagram



Bryde (2008) employed 5-point Likert questionnaire and SEM confirmatory factor analysis to examine the relationships between transformational leadership behaviours and project success.

Yilmaz and Tamer (2017) used a 5-point Likert scale to measure project team members' perceptions of transformational and transactional leadership behaviours, and their impact on job satisfaction and project performance. Similarly, Park and Kim (2018) used a 5-point Likert scale and Kruskal-Wallis test to measure project team members' perceptions of leadership effectiveness, and whether there were significant differences in leadership effectiveness ratings between international and domestic projects.

Another account by Javed et al. (2021) on the measurement of team members' perceptions of the project manager’s leadership styles employed a 5-point Likert scale and used descriptive statistics and hierarchical regression analysis to examine the relationship between leadership styles (transformational, transactional, and laissez-faire) and project success.

Rahman et al. (2018) used SEM to study the relationship between emotional intelligence, transformational leadership, and project success. The results indicated that emotional intelligence had a positive effect on transformational leadership, which in turn had a positive effect on project success. Kong et al. (2020) used a 5-point Likert scale to measure team members' perceptions of their organisation's culture and their project managers' leadership behaviours. They used factor analysis to identify the underlying dimensions of organisational culture, and then used structural equation modelling to examine the relationships between organisational culture, leadership, and project performance. The results showed that supportive and innovative organisational cultures had a positive effect on transformational leadership, which in turn had a positive effect on project performance.

Koster et al. (2017) used SEM to examine the relationship between project leadership competencies and project success in the Dutch construction industry. They found that project leadership competencies had a direct effect on project success, as well as an indirect effect through the mediating variables of team effectiveness and client satisfaction.

Khapova et al. (2018) used SEM to examine the relationships between leadership, team learning behaviours, and team performance in engineering project teams. They found that transformational leadership had a positive effect on team learning behaviours, which in turn had a positive effect on team performance.

Yuliansyah et al. (2019) used SEM to examine the relationships between leadership styles, team trust, and project success in Indonesian engineering projects. They found that transformational and transactional leadership styles had a positive effect on team trust, which in turn had a positive effect on project success.

Wang and Kang (2019) used confirmatory factor analysis (CFA) and SEM to investigate the impact of authentic leadership on project performance. They found that authentic leadership had a significant positive effect on project performance through the mediating variables of job satisfaction and organisational commitment.

Kim and Shin (2020) used partial least squares structural equation modelling (PLS-SEM) to examine the relationships between leadership styles, trust, and knowledge sharing in project teams. They found that transformational leadership had a positive effect on trust, which in turn had a positive effect on knowledge sharing.

Wu et al. (2021) used SEM to investigate the effects of leadership style, knowledge sharing, and innovation performance in construction projects in China. They found that transformational leadership had a positive effect on knowledge sharing and innovation performance, while transactional leadership had a negative effect on knowledge sharing.

Lee and Yang (2021) used SEM to explore the relationships between ethical leadership, knowledge sharing, and innovation in engineering design firms. They found that ethical leadership had a positive effect on knowledge sharing and innovation, and that knowledge sharing mediated the relationship between ethical leadership and innovation.

There are two main types of SEM: covariance-based SEM (CB-SEM) and partial least squares SEM (PLS-SEM).

Raza and Qureshi (2020) used PLS-SEM to investigate the relationships between transformational leadership, knowledge management, and project success in the context of construction projects. The results showed that transformational leadership had a significant positive effect on knowledge management, which in turn had a significant positive effect on project success. The authors concluded that transformational leadership plays a critical role in promoting knowledge management and project success in construction projects.

Ismail et al. (2018) used PLS-SEM to examine the relationships between leadership styles, organisational culture, and project performance in the construction industry in Malaysia. The results showed that both transformational and transactional leadership styles had a significant positive effect on project performance, and that organisational culture mediated the relationship between leadership styles and project performance. The authors suggested that organisations should focus on developing a strong organisational culture that supports effective leadership practices in order to enhance project performance.

Another recent research, that is very relevant to this dissertation, by Yadav and Yadav (2020) employed PLS-SEM to investigate the effect of project complexity, organisational settings, team characteristics, and external business environment on the leadership style exhibited by project managers in the construction industry. The authors collected data from 224 construction professionals using a self-administered questionnaire. The results showed that project complexity, organisational settings, team characteristics, and external business environment had a significant effect on the leadership style exhibited by project managers. The authors suggested that project managers should adapt their leadership style to the changing project conditions in order to achieve better project outcomes. The authors aimed to investigate the effect of project complexity, organisational settings, team characteristics, and external business environment on the leadership style exhibited by project managers in the construction industry. The study was conducted in India, and data was collected from 224 construction professionals using a self-administered questionnaire.

Overall, SEM is a powerful statistical method for testing theoretical models of relationships among variables in leadership and project management research. By allowing researchers to examine both direct and indirect relationships between variables, SEM provides a more comprehensive understanding of the complex relationships that underlie project success.

3.5.2 Qualitative Data Collection and Analysis

Various methods were employed to analyse the data collected from semi-structured interviews including thematic analysis and content coding. Thematic analysis is a widely used method that involves identifying and analysing patterns of meaning within the data (Guest et al., 2012). Content coding involves identifying and labelling specific categories or themes that emerge from the data (Saldaña, 2015).

Other methods of qualitative analysis cited in literature include grounded theory, which involves developing a theory from the collected data, and narrative analysis, which focuses on the stories and experiences shared by participated project leaders (Strauss & Corbin, 2014; Silverman, 2016).

Qualitative analysis of the relationship between leadership styles and independent variables can provide rich insights into the complexities of leadership in engineering project management. However, it is important to note that qualitative research is often subject to bias, therefore, certain steps will be undertaken to ensure the validity and reliability of the qualitative analysis findings (Cresswell, 2014). The following steps were implemented for the qualitative analysis.

(a) Transcription. Transcribe the interviews verbatim and proofread, correct, clean-up, the transcripts to ensure accuracy and completeness (Creswell, 2014). Transcription involves converting the audio recordings of the interviews into written text. It is important to ensure that the transcripts are accurate and complete, and that they capture all of the relevant information from the interviews. Manual review and correction of the transcriptions was carried out as soon as the interviews were concluded, to avoid forgetting important details.

(b) Coding and content analysis of narratives. Manual coding and content analysis of narratives was primarily utilised to ensure that in-depth information is prudently captured as much as practicable. Automated content analysis was also employed to provide further elaboration and validation of the manual analysis. In this respect, bespoke computer algorithms were utilised to conduct content analysis and produce frequency analysis of key words, identify themes, and to carry out semantic analysis. Coding involves identifying and labelling the relevant information in the transcripts. This can be done using a combination of inductive coding (based on the data itself) and deductive coding (based on existing theories and concepts).

A systematic approach was followed in coding, content analysis, and thematic analysis to ensure consistency and standardization in qualitative analysis process (Braun & Clarke, 2012; Nowell et al., 2017). A combination of deductive (based on pre-existing concepts or theories) and inductive coding (based on the data itself) was performed (Braun & Clarke, 2012).

The coding of interview transcripts was undertaken systematically and repeatedly to sure that all relevant information is captured (Saldaña, 2016). If multiple coders are involved in the analysis, then inter-coder reliability was checked to ensure that the coding process is consistent and accurate. This involves comparing the coding of different coders and addressing any discrepancies or disagreements (Braun & Clarke, 2012).

Accordingly, coding was revised as necessary throughout the analysis process to combine or split codes, or to create new codes as themes emerged from the data (Saldaña, 2016).

Undoubtedly, coding is a crucial step in qualitative data analysis, and it involves identifying, labelling, and categorizing data into meaningful units. However, there are some common pitfalls that may be encountered during the coding process. The researcher was attentive to these pitfalls throughout the coding and analysis process as described below.

- Avoidance of over-reliance on existing codes or categories: researchers may rely too heavily on pre-existing codes or categories, which can limit the emergence of new themes or ideas. It is important to remain open and flexible in the coding process, and to allow themes to emerge from the data (Braun & Clarke, 2012).
- Ensure that codes are defined clearly: researchers may fail to define codes or categories clearly, which can lead to confusion or inconsistency in the coding process. Therefore, it is important to provide clear definitions and examples of each code to ensure that they are accurately represented (Guest et al., 2012).

- Lack of inter-coder reliability: If multiple coders are involved in the analysis, there may be discrepancies or disagreements in the coding process, which can compromise the validity and reliability of the findings. It is important to establish and maintain inter-coder reliability to ensure consistency and accuracy (Braun & Clarke, 2012).

- Failure to code all relevant data: researchers may overlook or miss important information during the coding process, which can limit the depth and richness of the analysis. It is important to code all relevant data, even if it appears to be redundant or irrelevant (Saldaña, 2016).

- Bias or subjectivity in coding: bias or subjectivity may inadvertently be introduced during the coding process. Therefore, it is important to be aware of one's own biases and to strive for objectivity and transparency in the coding process (Nowell et al., 2017).

By being aware of these potential pitfalls and taking steps to avoid them, this study endeavoured to achieve a rigorous, transparent, and accurate coding process.

(c) Categorization of coded data. Codes were categorized into broader categories or themes that capture the essence of the data. This was carried out through a process of constant comparison, where the researcher compares the codes and categories across the data set to ensure consistency (Glaser & Strauss, 1967). Categorizing involves grouping the codes into broader categories or themes. Some best practices for categorizing were implemented such as creating a visual map or diagram to help organise the categories and themes, continuously refining the categories and themes as new data is collected, and ensuring that the categories and themes are clearly defined and well-supported by the data.

(d) Analysis (hybrid deductive and inductive approach). Data were analysed by examining the relationships between the categories and themes, and navigating for patterns, contradictions, and exceptions that can help to further refine the analysis (Patton, 2015). Thematic analysis is a widely used approach to qualitative data analysis that involves identifying, analysing, and reporting patterns or themes within data. It is a flexible and adaptable method that can be used with different types of qualitative data, such as interviews, focus groups, and open-ended survey responses (Braun & Clarke, 2020). Thematic analysis can be conducted inductively, starting with an open and exploratory approach to the data, or deductively, using pre-defined themes or codes based on existing theories or concepts.

Thematic Analysis comprised a six-phase process which included: familiarizing oneself with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and summarizing the findings (Braun & Clarke, 2019). Each of these phases involves a series of steps that contribute to the development and refinement of themes. For example, in the phase of searching for themes, codes were compared to identify similarities and differences, and occasionally some codes were grouped to form provisional themes.

One of the strengths of thematic analysis is its flexibility, which allows researchers to adapt the method to suit their research questions and data. However, this flexibility also means that there is room for subjectivity and interpretation in the analysis process. To address this potential issue, the researcher was attentive and transparent about the analytical process and maintained a detailed account on the generation of themes (Nowell et al., 2017). Additionally, it is important to use established quality criteria to evaluate the rigor and trustworthiness of the analysis (Braun & Clarke, 2019).

Furthermore, the qualitative data were further analysed using Artificial Neural Networks (ANN) and Machine Deep Learning (MDL) using Python coding. ANN and MDL were utilised to analyse the transcribed content of the interviews, identify themes in the responses, delineate any emerging patterns, and to eventually map the cleaned and categorized responses to the formulated theoretical framework (Thornhill et al., 2009). The innovative implementation of ANN and MDL offered an advanced approach to narrative analysis and recognition of key words and themes. The artificial model was systematically trained using generic text from scholarly articles on leadership and from the piloted interviews with project managers.

Most importantly, data saturation during qualitative analysis was achieved through three categories, namely: code saturation, meaning saturation, and data saturation. It could be argued that data saturation was one of the most challenging, and time consuming, tasks pertaining to qualitative research due to the absence of universal benchmarking and the ambivalent opinions about potential bias and subjectivity of the researcher. Accordingly, data saturation was cyclically observed during the analysis until the analysis no longer yielded further insights or new emerging themes associated with the research questions. Relatedly, the emerging themes were progressively observed in tandem with the analysis of the qualitative data, obtained from the interviews, both sequentially and in parallel. This was performed by gauging any replication in the response and feedback by the participants to the redundancy analysis of codes and themes. Additionally, the careful selection of participants through purposive multi-criteria sampling effectively contributed to the relevance of qualitative data; hence leading to a satisfactory and expedited level of saturation with the available number of interviews.

Quantitative data collected via the SAQ were triangulated with the qualitative data collected from interviews to corroborate and validate some emerging patterns and themes (Drouin et al., 2018). In this respect, data analysis was concurrent; however, data integration was sequentially conducted by performing qualitative analysis then validating the findings using quantitative data. It is important to emphasize that methodological triangulation was employed rather than mixed methods. Mixed methods follow a more structured approach to integration. Due to the limited size of the final qualitative data sample, and the rudimentary statistical analysis, mixed methods were not considered in this study.

Similar to the case of coding, while thematic analysis is a popular method in qualitative research, there are some common pitfalls that might be encountered during the analysis.

For instance, there might be a lack of clarity in defining themes which could lead to confusion and inconsistency in the analysis process. Therefore, it is important to provide clear definitions and examples of themes to ensure that they are accurately represented (Guest et al., 2012).

Likewise, over-reliance on preconceived ideas which can bias the analysis and limit the emergence of new themes. As such, it is crucial to remain open and flexible in the analysis process, and to allow themes to emerge from the data (Braun & Clarke, 2012).

Moreover, insufficient attention to negative cases and discrepancies in the data may result in lack of rigor in the analysis (Braun & Clarke, 2012; Nowell et al., 2017).

By being aware of these potential pitfalls and taking steps to avoid them, the researcher ensured that the thematic analysis was reasonably rigorous, transparent, and accurate.

(e) Interpretation of the analysed data. Findings were summarized by drawing conclusions that answer the research questions thereby providing detailed description of the themes and categories and how they relate to the research questions (Miles et al., 2020).

(f) Recursive review and re-analysis. The entire coding, content analysis, and thematic analysis was undertaken iteratively to verify the outcome from the predecessor analysis. Each iteration was properly and chronologically archived to allow review of data in due course if necessary.

Lastly, triangulation was used to examine the data collected from the survey and interviews. As explained earlier, the study primarily relied on qualitative analysis, since the research seeks in-depth understanding of leadership phenomenon; whereas quantitative analysis was merely used to corroborate, validate, and verify the outcome from the qualitative analysis. Accordingly, and to emphasise, the research did not pursue sophisticated statistical analysis techniques, and number crunching, which might often block the researcher from conceiving the big picture and the intricate complex interlinks between the variables, which sometimes cannot be fully discovered through conventional numerical approaches. Rather, the study employed a reasonable amount of statistical analysis to inform about, and to triangulate with, the meticulous content and thematic analysis of the qualitative data obtained from the interviews.

3.6 Summary

The objective of this research is to explore and explain the situational and dynamic leadership behaviour in the AEC industry throughout the project lifecycle, taking into consideration various influencing factors such as team characteristics, project complexity, internal organisational settings and structure, and external business environmental factors known as enterprise environmental factors (EEFs).

The research methodology is primarily qualitative as it seeks to gain an in-depth understanding of the leadership phenomenon. Furthermore, quantitative data were also collected using a 5-point Likert scale questionnaire to supplement qualitative data and corroborate findings pertaining to project managers' leadership attitudes and behaviour.

The samples were collected from a population of approximately 1,200 (revised population size after filtering of candidates based on study criteria) staff representing the project management community at an international engineering firm, and they included both male and female project managers from various engineering market sectors and global geographies. The samples were collected based on prescribed selection criteria. Ethical approval was obtained before commencing data collection, and confidentiality and privacy of survey and interview participants were ensured through appropriate measures.

Validity and internal reliability of the survey questionnaire were checked through a pilot test with selected senior project managers. After data collection, statistical analysis was carried out using Microsoft Excel and the programming language Python to conduct descriptive, ANOVA, correlational, Chi Square test, Pearson correlation, regression coefficient, and simplistic structural equation modelling. Python coding was also employed to analyse interview narratives where built-in machine learning modules were deployed to identify codes, analyse content, extract themes, and undertake sentimental analysis (i.e., positive and negative feelings about the researched leadership aspects). Thematic analysis of qualitative data was conducted using manual coding and analysis of transcribed narratives from virtual one-to-one interviews.

The outcomes of both qualitative and quantitative data analysis were triangulated to corroborate findings, revealing a high level of synergy and congruence. The statistical analysis of permutated pairs of survey questions also revealed statistical significance and a remarkable degree of correlation.

CHAPTER 4: RESEARCH FINDINGS

4.1 Quality of Collected Data

Maintaining trustworthiness of data and integrity in quantitative and qualitative research are of paramount importance and can only be achieved by adopting rigorous protocols, methodology, and analysis, and data management (Brod et al., 2009). There is relatively a common understanding of how quality of data and research results, portrayed through validity and reliability, can be tested in quantitative analysis, normally using universally adopted statistical methods. Comparatively, the literature shows a wide range of fragmented terminology used in the domain of data quality and trustworthiness of qualitative data analysis and research. A thorough review of extant research showed that some terms such as validity, rigor, trustworthiness, among others, are used interchangeably. Hayashi et al. (2019) mention that there is no universal agreement on what validity and reliability mean in a qualitative research context. For instance, validity and trustworthiness are sometimes treated as equivalent concepts whereas some articles cite trustworthiness as a broader concept that comprises validity and reliability (Golafshani, 2003). Similarly, there is diversity in the descriptions related to the concept of validity itself, and some scholars argue that validity and reliability are inapplicable to qualitative research (Golafshani, 2003; Stenbacka, 2001).

Trustworthiness in quantitative research comprises the validity and reliability of data. In this respect, there are well-defined statistical tests that can be used to measure validity and reliability. In contrast, there is no clear consensus in literature about the definition of reliability and validity in qualitative research; however, trustworthiness in qualitative research can analogously be achieved through four main criteria: credibility, transferability, dependability, and confirmability (Atherton & Elsmore, 2007; Creswell & Miller, 2000; Golafshani, 2003). Some scholars argue that some aspects of trustworthiness, such as reliability, can hardly be achieved due to the highly flexible nature of qualitative inquiry and the wide range of analysis involved, which often render the analysis process as non-repeatable. Likewise, validity could be affected by the perception and epistemological stance of the researcher in addition to the paradigm assumptions (Creswell & Miller, 2000).

Instead of dealing with isolated concepts such as validity, reliability, generalizability, etc., this research adopts a cradle-to-grave quality approach by operationalizing trustworthiness of data and quanti-qualti analysis through a holistic process-based approach. Such process highly depends on the researcher's attitude, transparency, rigor, and prudence, and shall be conceived through every research step including research design, data collection, organisation of collected data, codification, data analysis, and ultimately in the discussion of results (Hayashi et al., 2019). Nevertheless, the different concepts related to trustworthiness of quantitative and qualitative data are presented separately hereinafter to address their challenges and implications.

4.2 Validity and Reliability

Internal validity refers to the ability of the questionnaire to measure what is intended to be measured using methods such as content validity, criterion-related validity, and construct validity. Content validity assesses and determines whether the questions provide adequate coverage of the research subject. A such, the questionnaire was tested and assessed to determine if a question is "essential", "useful but not essential", or "not necessary". The testing was conducted through a Pilot study to carefully judge and articulate the questions (Alvesson, 2017). Criterion-related validity, also known as predicative validity, refers to the ability of the measures (i.e. questions) to make accurate predictions. This was achieved using statistical analysis test such as Cronbach's alpha coefficient as described in chapter 3. Reliability means consistency and measures robustness of the questionnaire. Although a question could be reliable, producing the same results consistently, it might still be invalid. Therefore, validity and reliability are imperative. Internal consistency can be estimated using statistical methods such as Cronbach's Alpha. Therefore, the Pilot study was utilised as a means to address the validity and reliability of the quantitate data collection tool. Designing questions: adopt other existing questions, adapt questions, create own questions. The SAQ was intranet mediated. Responses from questionnaire using web-based tools were automatically captured and converted to raw data into Microsoft Excel.

Regarding qualitative data, electronic synchronous interviews were conducted using intranet which had a significant advantage where the population are geographically dispersed. Standardized interviews based on predetermined questions allowed for consistent approach to the interview although the semi-structured and unstructured approach was often adopted for some questions to solicit further insights from the participants. This approach was adopted, as also explained in chapter 3, because it seeks to describe and explore leadership phenomenon. Fama et al. (2022) used structured interviews with open-ended questions to study difficulties in people with aphasia. The semi-structured, non-standardized, questions were based on a list of themes and questions that varied from interview to another. Moreover, the order of the questions also varied depending on the flow of the conversation. The occasional use of unstructured questions aimed at exploring in-depth understanding of the intricate aspects of leadership phenomenon. Relatedly, the interviewee is given the opportunity to talk freely about leadership behaviour and attitudes for him/herself and the team. This approach is sometimes known as Informant or Qualitative interviews since it is the interviewee's perceptions that guide the conversation, and statistical generalization about the population cannot be achieved for such types of unstructured questions.

As mentioned earlier, trustworthiness was observed though a processual approach that was adopted for all research steps. For qualitative data collection, the process covered the interview protocol to guarantee consistency and repeatability of results. The consistency was observed through systematic steps including opening the interview to build rapport, demonstrating in-depth knowledge in the subject to gain the participant's confidence, using appropriate neutral language (but not uninterested signs), avoiding body gestures despite using online camera, appropriateness of asking the questions, active listening and eye-contact, use of critical incident technique, use probing questions, tolerating and dealing subtly with some digress from the focus of the interview (avoid offence), removing cultural bias especially when interviewing project managers from western geographies, testing and summarizing the understanding of an oral response (repeating the respondent's answer to ensure full understanding of response), taking notes in written and diagrammatic style, in addition to the verbatim transcribed accounts, in order to capture key words, phrases, codes, and themes.

The lack of standardization in conducting interviews may lead to reliability and bias issues. Bias may occur as Interviewer Bias or Interviewee Bias, also known as Response

Bias. Interviewer Bias is where comments, tone, or non-verbal behaviour of the interviewer creates bias (e.g. impose your own beliefs) in the way the interviewee responds to the questions. The nature of the unstructured interview may seem intrusive to the interviewees; therefore, some might choose not to reveal aspects of the subject because of sensitivity to the exploratory approach (Golafshani, 2003; Stenbacka, 2001).

4.3 Trustworthiness of Qualitative Data and Analysis

As described in chapter 3, content analysis and thematic analysis were used to analyse the data obtained from the interviews. Content analysis relies on deductive theory-driven analysis of data and is quantitatively described using frequency of in vivo and coded bits of data. Thematic analysis follows an inductive reasoning and is data-driven (Humble & Mozelius, 2022). The inductive reasoning enables the exploration of nuanced perspectives, unique insights, and in-depth reflexive perceptions of social phenomena. Directed content analysis, which starts with theory based on the variables stipulated in the theoretical framework, was implemented using both pre-defined codes and new codes generated during the analysis (Humble & Mozelius, 2022).

A processual approach was adopted to ensure trustworthiness of collected data and qualitative data analysis. Lincoln and Guba (1985) provide a foundational framework for assessing trustworthiness in qualitative research, outlining these four key criteria. Nowell et al. (2017) emphasise the importance of rigorous methods and reflexivity in thematic analysis to meet these criteria. Ensuring trustworthiness in qualitative analysis, whether through content or thematic analysis, involves a combination of rigorous methodological practices, clear documentation, and reflective processes to ensure that the findings are credible, transferable, dependable, and confirmable. Braun and Clarke (2021) stress the significance of a transparent and reflexive approach in thematic analysis to ensure the trustworthiness of the findings. Similarly, Nowell et al. (2017) emphasise the role of member checking and detailed documentation in maintaining the integrity and credibility of qualitative research. Hsieh and Shannon (2005) discuss how a systematic approach in content analysis, accompanied by an audit trail, is vital for ensuring dependability and confirmability. These recent contributions to the literature reinforce the critical aspects of ensuring trustworthiness in qualitative research, highlighting the ongoing evolution and refinement of methodologies in content and thematic analysis.

Unlike quantitative data which are amenable to numerical measurements, there are no clear conventions which researchers can use in the case of qualitative data analysis, and guidelines to protect against self-delusion, subjectivity, and invalid interpretation are crude and scare (Lancaster, 2005). The precise approach of qualitative data analysis varies according to the nature and objectives of the research in addition to the researcher's orientations, preconceptions, and intentions on what is being measured and how. Nevertheless, such less strict and well-defined guidance, which could leave room for subjectivity, indeed offers serendipitous opportunities to explore social phenomena. In this respect, the open-ended subjectivity nature of qualitative analysis which is manifested in the potential variance in opinions, conceptualizations, and individual interpretations can be deemed as the very strength of qualitative analysis and potentially offers rich soil for discovering hidden themes and grounded theory.

Qualitative analysis should be overt and transparent regarding the metaphoric juxtaposition of evidence revealed from the data (Chenail, 2012b). Mixed methods were used as a validation approach to test the convergence between different sources of data and to corroborate evidence obtained from qualitative data (Creswell & Miller, 2000). When conscientiously implemented, mixed methods allow for a reasonable comparison and sense checks between qualitative and quantitative results to assess the consistency of collected data (Hayashi et al., 2019). Attempts to satisfy the five dimensions of trustworthiness, namely: credibility, transferability, dependability, confirmability, and generalizability are described hereafter. It should be emphasised that researchers often disagree on whether all the aforesaid dimensions must be applicable to a specific research paradigm or epistemological stance. Therefore, this research takes a balanced approach to these trustworthiness elements and focuses on the processual approach to trustworthiness rather than on emphasizing isolated concepts and using certain corresponding tests to validate them.

Credibility refers to the accuracy and believability of the findings from the participants' perspective. Generally, qualitative analysis is considerably complex, nuanced, and has several analytical approaches associated to it (Braun & Clarke, 2006). The use of theoretical sampling, also known as purposeful sampling, greatly contributed to the credibility of qualitative data (Brod et al., 2009) since interviews were conducted with a relevant sample of senior project managers from different geographics and industry sectors. Credibility was observed in content analysis and thematic analysis. In content analysis, credibility was attempted through techniques like member checking (asking participants to verify the interpretations), prolonged engagement (spending sufficient time to understand the context), and using multiple methods or data sources. Whereas in thematic analysis, credibility was enhanced by a detailed and thorough coding process, where themes are developed and refined in a way that faithfully represents the data. Peer debriefing, where other researchers review the analysis, can also be beneficial. In this respect, Chakrabarti and Frye (2017) raise a dilemma question on whether the “interpretation suit the data” or the “data suit the interpretation?”. Relatedly, the absence of replicable coding strategies “leaves qualitative claims susceptible to criticisms of validity.” (p.1356). FUCHS (2023) clarified that validity and reliability of thematic analysis can be achieved by prioritizing transparency and implementing manual rigorous coding approach, analysis which ultimately leads to insightful and robust findings.

Transferability is the extent to which the findings can be applied to other contexts or groups. In content analysis, detailed description of the research context and participants allows readers to judge the applicability of the findings to other settings. While in thematic analysis, providing rich, thick descriptions of the data and the context in which the data were collected helps others determine how the findings might transfer to other contexts.

Dependability involves showing that the findings are consistent and could be repeated. In content analysis, this was addressed by providing a clear and detailed description of the research process and methodology. Keeping an audit trail that documents all decisions and changes in the research process is also important. In thematic analysis, dependability was improved by a rigorous process of coding and theme development, ensuring that the analysis process is logical, traceable, and clearly documented. Confirmability is the degree to which the findings are shaped by the respondents and not researcher bias, motivation, or interest. For both content and thematic analysis, confirmability was achieved through an audit trail, which includes raw data, analysis notes, and decisions made during the research process. Reflexivity, where the researcher continually reflects on and documents their own biases and how these might impact the research, is also crucial.

Generalizability might arguably be the most challenging issue in qualitative analysis, particularly for case studies. The critique regarding the generalization and rigor of qualitative analysis is echoed by many of those inside and outside the research field (Braun & Clarke, 2006). However, Bryman (2012) pointed out that this might not be the case, especially when research involves large global organisations. Therefore, a single case study organisation, such as the engineering firm selected in this research, could potentially encompass a wide number of contextual settings in comparison with another survey that might be restricted to a particular context (e.g. national culture, geographic location, etc). Another issue with generalizability is significance of the qualitative interviews to theoretical propositions. If the researcher is able to relate his findings to existing theory, then the researcher will be in a position to demonstrate that the findings have a broader theoretical significance. From another perspective, researcher normally use limited excerpts from of text data to illustrate the broader theoretical understanding. In this respect, although most scholars would ensure that these excerpts are not idiosyncratic, the ability to make the selection more transparent is still debatable hence the cited anxieties about obfuscating and undermining the generalizability of the interpretive claims. Similarly, a common critique of generalizability is the issue of selective picking of quotes that might not be representative of the qualitative data corpus (Chakrabarti & Frye, 2017). For example, the researcher might be tempted to cherry-pick excerpts from text date where the interviewees eloquently express their opinions and insights (Chakrabarti & Frye, 2017). Ozuem et al. (2021) mentioned that the effectiveness of thematic analysis has come under criticism due to complexity and the diverse underpinning qualitative approaches that are used to make sense of the data.

4.4 Quantitative Analysis Results

The qualitative data collected via SAQ was analysed using ANOVA, frequency, and correlation statistical methods. The sample of 300 project managers was selected based on non-probability and purposive technique because the SAQ targeted the corporate project management community, which consisted of certified project managers only, in order to deliberately produce a valuable set of data (Owusu-Manu et al., 2020). As explained earlier, the research is predominantly qualitative, and is focused on exploring leadership phenomenon and understanding the in-depth intricate dynamics of project leadership in the complex engineering industry. Therefore, it would be unjustified to over rely on statistical techniques, and quantitative analysis was merely employed to triangulate with the results obtained from the qualitative data analysis (QDA). Due to the simplistic approach, the statistical analysis was conducted using Microsoft Excel and Python Stats Module.

Quantitative data was electronically obtained through corporate intranet and exported into Microsoft Excel. The data was then cleaned and organised to facilitate statistical analysis and graphical representation. The spreadsheet layout also enabled exporting the tabulated data to Python to enable further quantitative analysis. Table 4.1 shows a truncated sample of the cleaned and organised ordinal data obtained from the SAQ responses.

Table 4.1

Cleaned and organised ordinal data obtained from SAQ (tabulated data is truncated for convenience)

Respondent	Gender	Region	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1	M	West	5	2	3	4	4	5	4	4	4	4
2	M	West	5	2	4	4	4	5	5	4	4	4
3	M	West	5	1	3	4	4	5	5	4	4	4
4	M	West	5	1	3	3	5	5	5	5	3	4
5	M	West	4	2	2	5	4	5	5	5	4	4
6	M	West	5	3	4	4	4	5	5	5	5	5
7	M	West	5	2	4	3	5	4	3	5	4	4
8	M	West	4	2	3	4	4	5	5	4	3	4
9	M	West	4	1	3	4	5	5	4	5	3	5
10	M	West	4	1	3	3	4	5	5	4	4	4
11	M	West	5	1	2	2	5	3	5	5	4	5
12	M	West	5	2	1	4	4	4	5	4	3	5
13	M	West	5	2	2	5	4	5	4	4	4	5
14	M	West	4	2	2	3	4	4	5	4	3	5

The data sample included circa 300 project managers from different regions and industry sectors. Response was confirmed from 126 project managers (response rate 43%). The categorical attributes employed in the analysis are gender and geography since it is hypothesized that these attributes impact leadership styles and behaviour, particularly for complex projects and crisis management. The demographic profile of the respondents is shown in Table 4.2. Clearly, the responses were predominantly received from male project managers who constituted 84% (106 nos.) of the respondents while female respondents constituted 16% (20 nos.). This indicates that project management in construction and engineering is still dominated by male engineers. The demographic profile also shows a relatively balanced distribution of male respondents based on geography with a percentage between western and eastern regions of 33% and 67%, respectively. Comparatively, the majority of female respondents was based in western regions with a percentage of 85% compared to 15% for eastern geographies, which is an indication of the low number of female project managers in the eastern geographies such as the Middle East.

Table 4.2

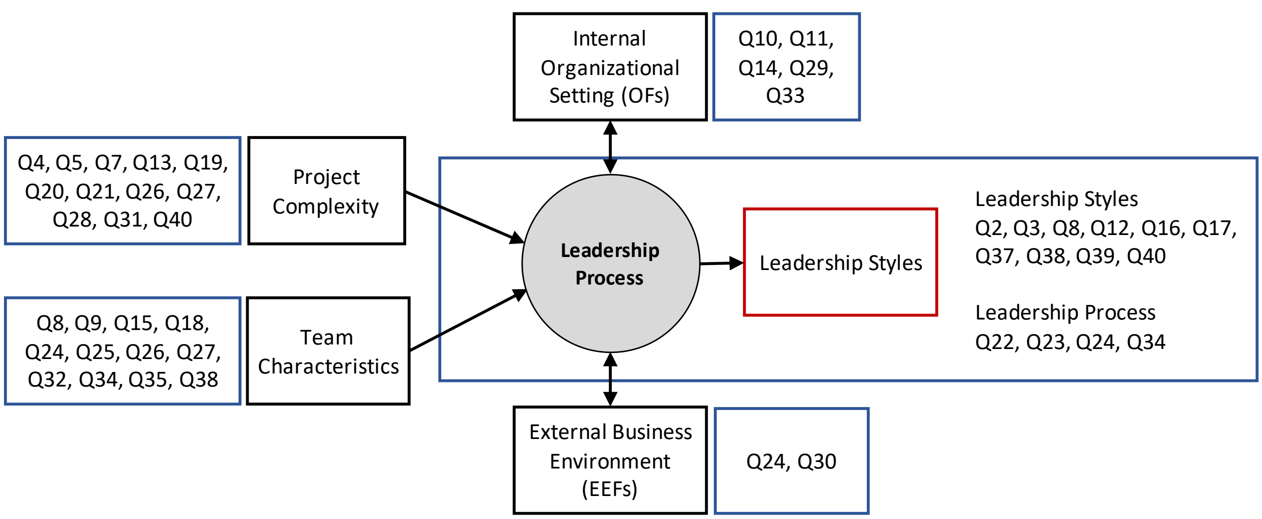
Demographic profile of SAQ respondents

Gender	Frequency	Total No.	% Gender	Region	% Region
Male	35	106	84%	West	33%
Male	71			East	67%
Female	17	20	16%	West	85%
Female	3			East	15%
Total No. of Respondents		126			

Although the response rate was below expectation the number of responses was still sufficient to undertake satisfactory quantitative analysis and subsequently triangulate the results with the QDA outcome. Further, the size of the sample (300 nos.) was originally adequate as explained in Chapter 3. For instance, Latif et al. (2020) collected data from 304 project workers in software projects and used structural equation modelling to study entrepreneurial leadership (EL) and to analyse the causal relationships between EL, Knowledge Management (KM), and project success. Luo et al. (2021) used survey questionnaire with a sample size of 200. A total of 138 were collected with a response rate of 76.6%. The number of responses in Luo et al. (2021) is close enough to the number of responses in this research. Bilal et al. (2020) also used self-administrated survey (paper-pencil) and structural equation modelling to examine the impact of the follower-centric servant leadership style on team effectiveness in the software industry in Pakistan. Ali et al. (2021) used questionnaire survey and SEM to study the relationship between humble leadership and project success for IT projects in Pakistan. The response rates and number of responses found in the aforesaid accounts were also reasonably close enough to the ones in this research. The interpretation of the quantitative data was facilitated by the mapping of the SAQ questions to the variables given in the theoretical framework as depicted in Figure 4.1. As clearly shown in Figure 4.1, some of the questions are mapped to more than one variable as due shared substance. For example, Q40 addresses project complexity and the corresponding leadership behaviour if more trust is built between the leader and subordinates. The questions asks whether a project manager can become less authoritative and empower followers in complex project environments as more trust is being established. As later seen in the results of the QDA, this is a very intricate subject with ambivalent opinions, but generally there was a consensus on assuming less authority as team members become empowered even for complex projects but with precaution and continuous monitoring of the team.

Figure 4.1

Mapping of questionnaire to variables in the theoretical framework

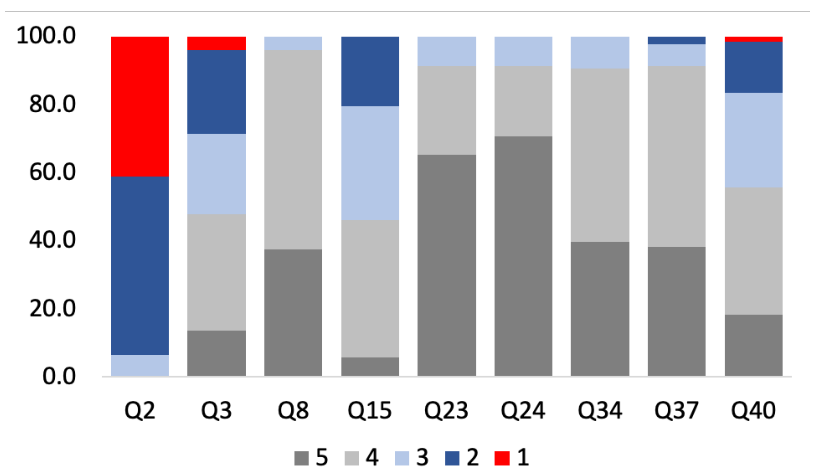


The analysis then proceeded through the studying of frequencies of responses and the correlation between the pairs of questions, which unsurprisingly was an arduous task due to the large number of questions. Examples of response frequency analysis and correlation between pairs of questions are illustrated in Figures 4.2 and 4.3, respectively.

For instance, Figure 4.2 reveals that questions 23 and 24 have a high percentage of score 5 which is an indication of the high agreement that project leaders shall tailor their leadership styles according to project dynamics but might not need to change a specific leadership style when leading teams remotely. This agrees with responses from Q2 which shows that a project manager should not exhibit a consistent leadership style throughout the life cycle of the project. The former subject related to leadership and project dynamics is a highly under-researched topic as explained later. The latter subject is also rarely addressed in contemporary research despite its importance.

Figure 4.2

Frequency analysis of responses (5-point likert score is color-coded)

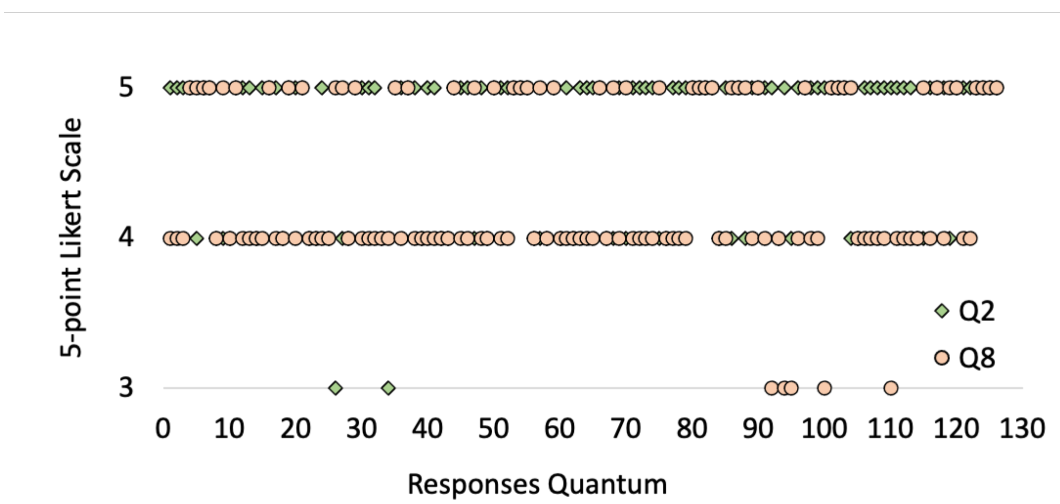


On the other hand, the analysis of question 24 enabled a reasonable interpretation that leadership styles that could be efficient for in-person interaction with team members are probably going to be efficient for the case of leading teams remotely (i.e. virtual teams). The previous analysis helps to corroborate whether situations that warrant virtual work which is ubiquitously becoming a normal mode of work, such as the case of Covid-

19, requires different leadership styles under the same circumstances. Similarly, the analysis of the question pair Q2-Q8 as shown in Figure 4.3, which is related to situational leadership, shows congruence in the responses with high agreement that switching between leadership styles is justifiable to cope with certain circumstances such as crisis situations or technically demanding engineering submissions with aggressive deadlines. The valuable results obtained from question pair analysis were used to substantiate the themes obtained in the QDA as described in the next section.

Figure 4.3

Distribution of responses for Q2 and Q8 (questions are color-coded)



Frequency analysis of geography-based responses was also conducted to examine the influence of national culture on the responses; hence, to infer about project leadership behaviour, dyadic leader-follower process, and team dynamics in western and eastern project contexts. For example, Figure 4.4. shows responses to Q25 which examines whether an authoritative leadership style is preferable when leading large virtual multi-national teams. This situation is becoming commonplace for complex and technically demanding projects where global teams from different countries participate to deliver multi-disciplinary design projects. The responses from Q25 show a consistent perception by western and eastern cultures with tendency that an authoritative leadership style could be preferable, and probably more effective, when leading large multi-national virtual teams.

Figure 4.4

Response to Q25 categorized by region (Response score is color-coded)

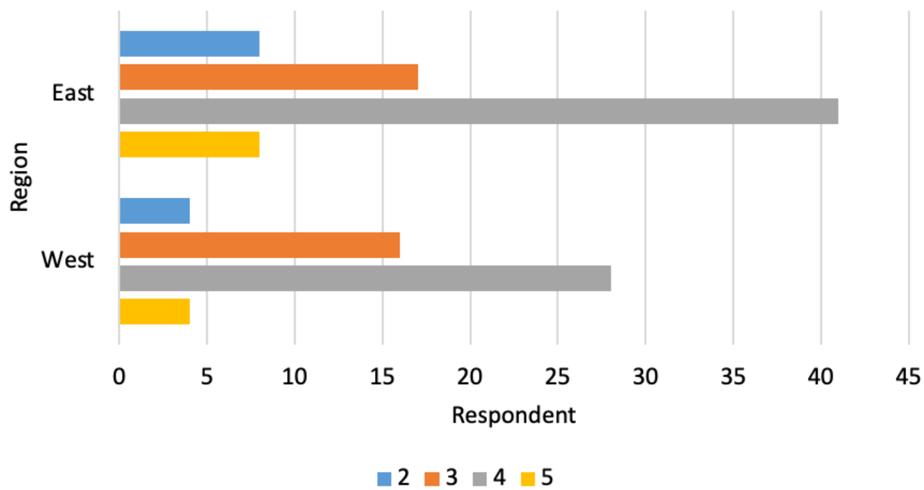


Table 4.3 shows responses analysis with the aforesaid stark consistency between western and eastern stances. For example, around 55.4% of eastern project managers agreed that an authoritative leadership is more effective for large virtual teams, whereas almost equally 53.8% of western project managers agreed on the same. Similarly, neutral response from western and eastern geographies was nearly equal at 30.8% and 23.0%, respectively.

Table 4.3

Frequency analysis of Q25 responses (grouped by geography)

	Q25 Response Scores			
Region	**2**	**3**	**4**	**5**
East	8	17	41	8
	10.8%	23.0%	55.4%	10.8%
West	4	16	28	4
	7.7%	30.8%	53.8%	7.7%
Total Nos.	12	33	69	12
%	9.5%	26.2%	54.8%	9.5%

The quantitative results were in good agreement with the QDA outcome which also showed a tendency, regardless of region, for project managers to exhibit more authoritative leadership styles to control large multi-national teams, particularly under aggressive project conditions such as stringent deadlines, stakeholder complexity, technical complexity, or crisis situations that warrant decisive and swift actions by the project manager and immediate implementation by the project team members. Interesting results were also obtained from the responses to Q26 and Q27. Nearly 70% of the respondents gave scores of 4 and 3 for both questions as illustrated in Figures 4.5 and 4.6. Generally, a significant number of responses revealed tendency among subordinates to follow the project leader than being empowered in complex task situations. The result for eastern cultures is congruent with literature. Unexpectedly, subordinates from western cultures also demonstrated similar tendency and preference for command and control in complex task environments. QDA outcome was in agreement with the aforesaid results. This breakthrough result is further elaborated in the next sections.

Figure 4.5

Frequency of responses to Q27

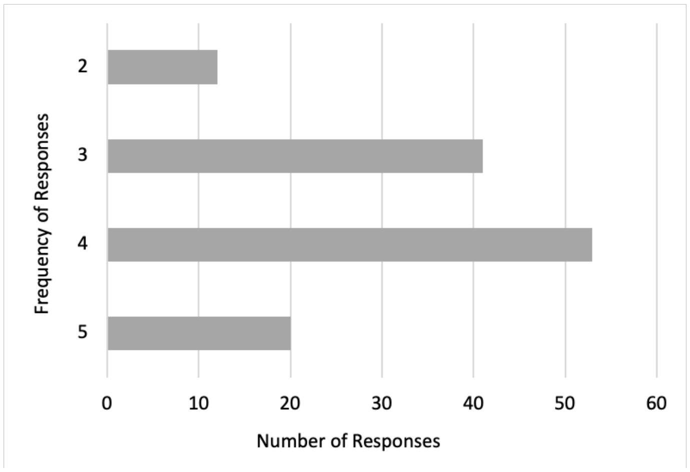
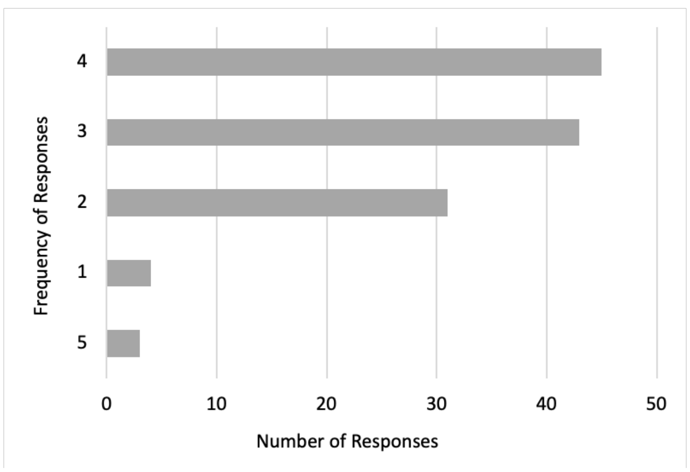


Figure 4.6.

Frequency of responses to Q26



Further investigation of relationship between pairs of questions was facilitated through correlation analysis using Pearson correlation coefficient. The analysis was undertaken using statistical analysis correlation tool in Microsoft Excel. For instance, the results show a significant inverse correlation between Q4 and Q5 with a correlation coefficient of -0.3286 as shown in Table 4.4. below. Basically, this implies that projects with complex conditions, such as complex stakeholder environments, require more authoritative leadership styles. Therefore, empowerment of subordinates in such complex situations do not always produce the desired results; hence might inadvertently have adverse impact on the project performance. One of the QDA themes strikingly captures and supports the aforesaid inverse relationship. Relevant practical examples, from real-life projects, appear in the interview narratives and are further described in the next section.

Table 4.4

Pearson correlation results for pairs of questions (table truncated for convenience)

	Q1	Q2	Q3	Q4	Q5	Q6	Q7
Q1	1.0000						
Q2	0.0312	1.0000					
Q3	-0.0041	0.1685	1.0000				
Q4	0.0450	0.0832	0.0183	1.0000			
Q5	0.0277	-0.0758	-0.0859	-0.3286	1.0000		
Q6	-0.0952	0.0663	0.1837	0.0173	0.0106	1.0000	
Q7	-0.0874	-0.1421	-0.2014	-0.0743	0.1470	0.0325	1.0000
Q8	-0.0096	0.0164	0.2107	0.0909	0.0254	0.0351	0.0920
Q9	0.1712	-0.1047	0.0742	-0.1255	0.0283	-0.0284	-0.1487
Q10	0.0093	-0.0247	-0.1498	-0.0604	0.0453	0.0281	0.1152
Q11	-0.1889	0.1070	0.1146	-0.0537	-0.1827	0.2560	-0.0853

The next subsections 4.1 to 4.5 show the quantitative data analysis results of the responses in a similar systematic fashion based on the variables depicted in the theoretical framework. The results are described based on the analysis of the corresponding SAQ questions associated with each variable, as shown earlier in Figure 4.1, in order to corroborate statistical significance and establish common themes attributed to each variable. The quantitatively driven themes are subsequently triangulated with the themes developed in the QDA as described in section 5.

4.4.1 Project Complexity

Project complexity has become ubiquitous in the construction and engineering industry. Clients and stakeholders have become more sophisticated and demand. Statutory and regulatory requirements, such as environmental compliance, have remarkably grown in complexity due to climate change and emphasis on protection of local communities. Similarly, technical complexity has reached unparalleled levels with the emergence of mega and giga projects such as the NEOM in Saudi Arabia and Thames River Stormwater Management in UK, among many others. There is universal consensus that project complexity requires superior leadership skills. As a matter of fact, leadership has become unanimous with complexity in the engineering industry, where project managers are expected to exhibit high standards of leadership to ensure successful outcomes. Therefore, project complexity was setup as an essential independent variable in the theoretical model as explained in Chapter 2. The quantitative results of the SAQ questions associated with project complexity are described hereafter.

A logical starting point is to understand whether project leaders appreciate and understand project complexity, what constitutes complexity, its plausible influence on leadership and project performance, and how leaders address complexity. This inquiry was sought thorough questions 13, 19, 20, 2, and 28 as shown in Table 4.5. Evidently, there was a consensus among the respondents that a formal assessment of complexity from the outset, at project planning or initiation, is not given enough attention and is barely performed by project managers, as seen by the average score of 3.03, indicating that respondents were natural about whether project managers assess complexity beforehand. Surprisingly, although complexity is an essential part of project management as found in literature, this research revealed that it is critically less formalized than other aspects of project management.

Table 4.5

Project complexity (descriptive statistics)

Statistical Measure	Project leaders commonly assess complexity from the outset	For complex problem-solving situations, project leaders normally select whom to engage from team members	Project Complexity is governed by technical aspects	Project Complexity is governed by stakeholder environments	Project Complexity is governed by EEFs
Mean	3.03	4.29*	3.17	3.83*	2.19**
Median	3	4	3	4	2
Mode	4	4	3	4	2
Standard Deviation	0.9874	0.6333	0.8367	0.8832	0.6814
Kurtosis	-0.7092	-0.6581	-0.8144	-0.4309	-0.5548
Skewness	-0.1656	-0.3315	0.0925	-0.4445	-0.1164
Confidence Level (95.0%)	0.1741	0.1117	0.1475	0.1557	0.1201

Another important result is the selectivity of team members in complex situations. Apparently, project managers tend to select whom to engage from the subordinates on complex problem-solving tasks. This is evident in the high score of 4.29 which depicts general agreement that project managers become careful on picking competent team members, probably the preferred empowered ones, to handle complex tasks. Arguably, there is usually a strong trust relationship between the leader and those groups of subordinates. The aforesaid result is in full agreement with the corresponding theme developed in the QDA. The latter unequivocally revealed the formation of subgroups who are later assigned on specific complex tasks or who contribute to solving complex problems with assistance from the project leader.

Furthermore, the results show that the stakeholder environment is primary governing factor in defining project complexity. From the first instance, someone might think that technical aspects define project complexity. However, to the contrary of traditional thought, stakeholder management turned out to be the dominant factor contributing to project complexity. The results on complexity will be further discussed in findings hereinafter. The reciprocal effect of complexity on team members was also analysed as shown in Table 4.6. In this respect, respondents from eastern regions, with higher submissive traits, showed a tendency for following a project leader in complex project settings rather than being empowered. This exemplifies the natural desire among eastern subordinates to avoid making decisions or being at the forefront of complex tasks thereby feeling more secured when receiving instructions and directions from project leaders. This result was corroborated in the QDA which showed that in complex distressed situations, such as recovery of troubled projects, leader tend to be more authoritative and team members prefer following direct and clear orders to avoid committing mistakes and further exacerbating the status of the project or undermining the task in hand.

Table 4.6

Reciprocal influence of complexity on subordinates (descriptive statistics)

Statistical Measure	For eastern regions, complexity discourages the desire to become empowered so subordinates prefer to follow a project leader	For western regions, complexity discourages the desire to become empowered so subordinates prefer to follow a project leader
Mean	3.64	3.10
Median	4	3
Mode	4	4
Standard Deviation	0.8622	0.9071
Kurtosis	-0.5961	-0.7014
Skewness	-0.1483	-0.2559
Confidence Level (95.0%)	0.1520	0.1599

In contrast, respondents from western regions seemed less concerned about complexity and their responses showed neutrality towards becoming less proactive in complex situations.

4.4.2 Team Characteristics

An important variable in the theoretical framework is pertains to the influence of team characteristics on the behaviour of the leader. As deliberated in the literature review, leadership is a reciprocal and dynamic two-way process. The leader behaviour affects followers either negatively or positively. Similarly, the characteristics and traits of followers may influence the leader who may elect to exhibit team-tailored leadership styles to ensure effective performance. For example, managerially mature and technically competent followers are likely to overperform in a transformational leadership environment, whereas less competent subordinates may feel safe in a command-and-control one. The effects of team characteristics are underrepresented in literature since most of leadership investigations are leader-centric. The results of the SAQ questions related to team characteristics are presented hereafter.

The results revealed a stark consensus among respondents, from western and eastern regions, on the need to adapt leadership styles based on the characteristics of the followers. The ANOVA analysis of the responses from Q8 is shown in Table 4.7. The results are also illustrated as a percentile distribution in Figure 4.7 which clearly corroborates a statistical significance with nearly all responses in agreement on leadership adaptation to team characteristics. As seen later in the results of the QDA, many project managers expressed their tendency to switch between leadership styles based on the behaviour and traits of team members such as, but not limited to, technical competency, collaborative spirit, professional conduct, managerial maturity, and communication skills.

Table 4.7

ANOVA of leadership styles adaptation to team characteristics

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.0181	0.0181	0.0592	0.8081
Residual	124	37.9819	0.3063		
Total	125	38			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	4.3543	0.0992	43.8940	0.0000	4.1579	4.5506	4.1579	4.5506
Respondent	-0.0003	0.0014	-0.2434	0.8081	-0.0030	0.0024	-0.0030	0.0024

Figure 4.7

Percentile distribution of responses to Q8

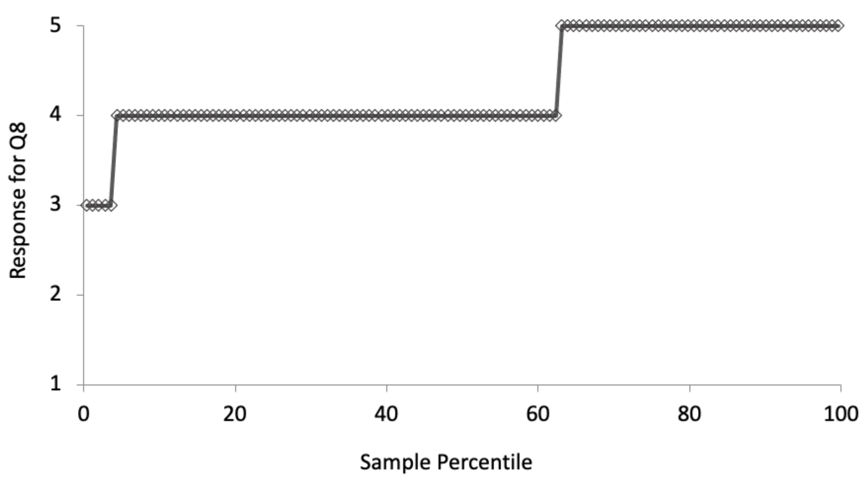


Table 4.8 summarizes the results of the questions on leadership adaptation to the characteristics of team members. The results show neutrality (average score 3.3095) towards the adaptation of leadership styles to the national culture of team members. This

implies that a leader's style is essentially independent from the team members national backgrounds; therefore, authority may not be an effective means to manage and lead teams even from those cultures who are perceived to be more submissive and less empowered. In contrast, there was common agreement (average score 4.4127) that a leader shall be attentive to the needs, characteristics, and traits of the team members such as technical and soft skills, commitment, professional conduct, values, principles, among others. This is further elaborated as found in the QDA results which show subgroup formation as an outcome of team dynamics based on the traits and maturity levels of the team members. Likewise, the results showed a high level of agreement (average score 4.6190) on the necessity to adapt one's leadership style to the mode of meeting conduct being in-person or virtual. Leadership adaptation based on in-person or virtual interaction was a peculiar aspect of the research, and was also cumbersome to delineate in the interviews with project managers.

Table 4.8

Descriptive statistics - leadership correlation with team characteristics

Statistical Measure	Leadership styles adaptation to national culture	Leader attentive to team needs and traits	Leadership adaptation to in-person vs. virtual teams	Authoritarian leadership fits large multi-national virtual teams	Complexity moderates subordinates followship in eastern cultures	Complexity moderates subordinates followship in western cultures	Preference for subgroups when leading large teams	Simultaneous adaptation to multiple leadership styles	In-person and virtual teams require different leadership styles	Coaching is applicable to inexperienced and experienced members
Mean	3.3095	4.4127	4.6190	3.6429	3.6429	3.0952	4.1984	4.3016	4.0476	3.7698
Standard Error	0.0768	0.0520	0.0573	0.0699	0.0768	0.0808	0.0552	0.0566	0.0720	0.0881
Median	3	4	5	4	4	3	4	4	4	4
Mode	4	4	5	4	4	4	4	4	4	4
Standard Deviation	0.8622	0.5834	0.6432	0.7845	0.8622	0.9071	0.6199	0.6359	0.8085	0.9892
Sample Variance	0.7434	0.3403	0.4137	0.6154	0.7434	0.8229	0.3843	0.4043	0.6537	0.9786
Kurtosis	-0.8622	-0.7111	0.9123	-0.0843	-0.5961	-0.7014	-0.5109	-0.6670	0.6017	-0.7649
Skewness	-0.1145	-0.3900	-1.4642	-0.4855	-0.1483	-0.2559	-0.1562	-0.3536	-0.8257	-0.2771
Range	3	2	2	3	3	4	2	2	3	4
Minimum	2	3	3	2	2	1	3	3	2	2
Maximum	5	5	5	5	5	5	5	5	5	6
Sum	417	556	582	459	459	390	529	542	510	475
Count	126	126	126	126	126	126	126	126	126	126
Confidence Level(95.0%)	0.1520	0.1029	0.1134	0.1383	0.1520	0.1599	0.1093	0.1121	0.1426	0.1744

There was an inclination towards the suitability of authoritarian leadership to large multi-national virtual teams (average score 3.6439, mode and median score of 4). Large global teams are becoming the new norm in project delivery particularly for mega and giga multi-disciplinary projects. For instance, many international firms are increasingly becoming dependent on offshore design centres, in the Middle East and far Asia, whom technical capabilities can be leveraged to deliver some technical disciplines such building information modelling (BIM) and hydraulic modelling for urban water and sewer networks. As such, a global team may consist of members of different global offices with simultaneous interaction. Such setup poses a leadership challenge for project managers who may need to exhibit different leadership styles concurrently to run such diversified team efficiently and effectively. The challenge is aggravated in crisis situations where global teams need to harmoniously cooperate to deliver a product, thereby necessitating the need for more command-and-control styles.

Interestingly, the responses show that complexity does not seem to moderate the team members tendency for authoritarian followship. In other words, teams like to stay empowered and make their own decisions even when involved in complex tasks regardless of geographic region. Nevertheless, the responses still show a skewness in eastern regions towards authoritarian followship with an average score of 3.6429 in comparison with 3.0952 for western regions. This means that eastern regions have higher tendency for authority preference during complexity situations such as performance of complex tasks.

There was high agreement on the need to form subgroups with delegated leadership when performing complex tasks. This means that a project leader can find a competent subordinate to whom leadership can be delegated. This person can then lead a subgroup who focuses on the technically demanding task. This approach, as seen in the QDA, is popular and powerful for multi-disciplinary complex projects such as engineering design of urban infrastructure and the built environment including dams, power plants, and bridges. Similarly, there was high consensus on the concept of simultaneous leadership styles which means that a project leader not only should switch between distinct styles but can also assume multiple leadership styles at the same time when running teams and subgroups. The extant literature is silent about this aspect of leadership as there is no scholarly research, or substantive models, that addresses the coexistence of multiple leadership styles in a specific business or project setting.

Responses also showed general agreement on the need to adapt leadership styles to in-person versus virtual team management settings. In this respect, the SAQ included two relevant questions as means for checking reliability and accuracy of responses. The responses to both questions were congruent (i.e. average score of 4.6190 vs. 4.0476) and showed agreement on the need for leadership adaptation. For instance, crisis situations might warrant decisive and swift decision making to move projects from a distressed to healthy status. In such critical circumstances, a project leader may attempt to be authoritative when leading virtual teams in order to control team behaviour, performance, and dynamics due to the lack of time for extended discussions and idea tossing. As revealed in the QDA, leading virtual teams was associated with a common theme of “follow my instructions” which puts emphasis on the need to be more authoritarian when managing complex projects that encompass global virtual teams. Furthermore, the results show coaching of team members is relatively dependent on team characteristics. Plausibly, more experienced and senior team members, with high competency, do not normally require coaching unlike new joiners or less qualified engineers. As such, coaching is selective based on team traits. This aligns with the result of leadership adaptation discussed earlier.

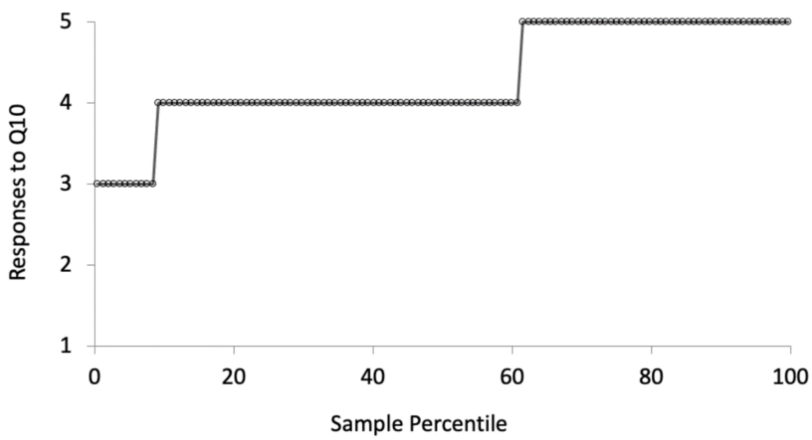
4.4.3 Organisational Structure

The impact of corporate internal organisational structure on project leadership is grossly under-researched. The internal organisational structure was conceptualized as an extraneous variable that mediates other independent variables; hence, has an indirect impact on the leadership process as illustrated in Figure 4.1. There are numerous aspects of organisational structure that can be potentially examined; however, it would certainly be unfeasible to account for all of these aspects. Therefore, the most relevant aspect of internal organisational structure; namely, the project delivery structure, was selected as the extraneous variable due to its plausible direct interlink with project management (PMI, 2017). The results of the quantitative data showed that organisational structure is conductive to high performance project leadership. Therefore, it is of paramount importance to the successful delivery of complex projects. This result is supported by the findings from the QDA.

Evidently, there is agreement on the positive impact of projectized organisational structure as seen in the responses to Q10. This means that project-based organisations, with no or less intervention from functional departments, positively mediates project leadership and enhances the project leader performance. In such structures, the project manager has the ultimate power and authority for decision making and the management of the technical staff. Effectively, the project team becomes like a small organisation with its own rules and procedures with the project leader as the CEO. The empowerment of the project manager manifests into autonomy and exhibition of leadership styles, that fit the situation in hand, without interference from other functional manager who otherwise would have some control over their technical staff such as in the case of the balanced matrix structure. Figure 4.8 illustrates the responses to Q10.

Figure 4.8.

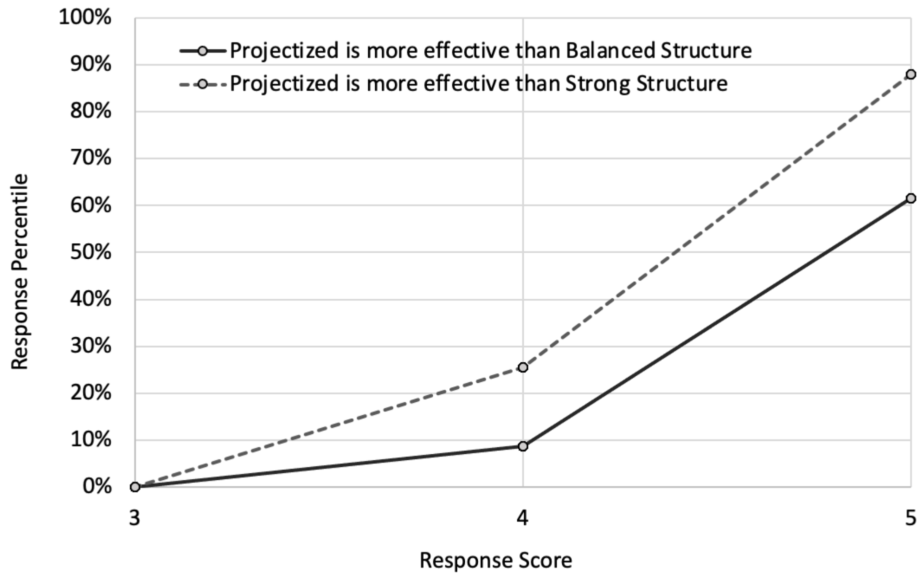
Percentile distribution of responses on projectized organisational structure



Comparatively, there was general agreement that a projectized matrix structure is more effective than both a balanced and a strong organisational structure (refer to Chapter 2 for definitions of projectized, balanced, and strong matrix structures). This can be evidently depicted in the frequency analysis of Q10 and Q11 as illustrated in Figure 4.9 below. The results show high percentile of either agreement or strong agreement on the effectiveness of a projectized matrix.

Figure 4.9

Frequency distribution of responses to Q10 and Q11 on projectized vs. balanced and strong organisational structures



4.4.4 External Environmental Factors

It is hypothesized that the external environmental factors (EEFs), as referred to in PMI (2017), have an indirect effect on project leadership. The EEFs simply reflect the external business settings such as stakeholders, legislative and regulatory requirements, level of ethical conduct, compliance, political forces, technological limitations, among others. Essentially, it is quite arduous to study the impact and correlation between the aforesaid variables and project leadership as this by itself warrants a separate extensive research enterprise. Accordingly, the current research merely aims at complementing the framework by introducing an extraneous variable to capture the effects of EEFs in a generalized broad fashion. In this respect, the two aspects that were captured in the quantitative data pertain to globalization and leading virtual teams. The external business environment has drastically changed over the past decade as extensively explained in Chapter 2. Briefly, clients have become more sophisticated, stakeholder networks have grown more complex, geopolitical forces dramatically become dynamic and unpredictable, and the demand for quick and cheap delivery of projects became an obsession for governmental agencies globally. These factors require engineering firms to run large global teams to meet such demanding objectives and constraints, and this puts more stress on project leaders who has recently become accustomed to managing large global teams from different backgrounds and national cultures. Hence, the analysis of the relevant questions, namely Q24 and Q30, could give an indication to the level of consensus on the impact of globalization on project leadership, and the correlation between project leadership and team location. The effects of globalization are more elaborately captured in the QDA which shows patterns and themes related to global project management practice and higher expectations from project leaders. Table 4.9 below shows the results of the F-test for two sample variances for Q24 and Q30.

Table 4.9

F-test two samples for variances Q24 and Q30

Statistical Parameter	Project leadership is contingent to team location (in-person vs. virtual teams)	Project leadership is contingent to globalization
Mean	4.6190	4.5079
Variance	0.4137	0.2679
Observations	126	126
df	125	125
F	1.5441	
P(F<=f) one-tail	0.0079	
F Critical one-tail	1.3436	

The F-test shows high level on agreement on the contingency related to globalization and team geographic location. This implies that project leadership behaviour and styles are contingent to EEFs to some degree. For example, project leaders might need to be more authoritative when leading teams in complex stakeholder environments. One of the relevant comments obtained by an interview participant from the Middle East stated that “complex stakeholder situations often require the project manager to be the follow-my-orders type to avoid complications with sensitive and demanding stakeholders, such as those officers in municipality and other government institutions”. Likewise, leading virtual teams on technically complex projects might put the project manager under pressure to make decisive and fast decisions to avoid schedule delays. In such circumstances, the project manager might exhibit more authoritarian leadership styles to control team behaviour, conflicts, and performance. However, as also revealed in the QDA, some project leaders might still be transformational in their behaviour, and their leadership styles and attitude might dynamically change based on team characteristics regardless of geographic location. For instance, the project manager might nominate a competent senior engineer to lead a subgroup for the completion of a technically demanding task. This sort of leadership delegation is rarely covered in scholarly research on engineering project management and leadership.

4.4.5 Leadership Process and Styles

Leadership is a complex social process with reciprocal exchange of influence between the leader and followers. The lack of deep understanding of leadership phenomenon despite the ample scholarly research can arguably be attributed to the oversimplified conceptualization and abstraction of the leadership theoretical formulations and models. As explained in Chapter 2, the majority of the models encountered in literature use simplistic construction of leadership variables, and rarely treat leadership as a dynamic process that is situationally and temporally contingent to internal and external variables such as team members characteristics, project settings and complexity, internal organisational structure and its conductivity to facilitate project management, and external business environment such as stakeholder network complexity. Undoubtedly, a single study cannot sufficiently encapsulate the intricate complexity of leadership; however, there shall be an acceptable level of abstraction to allow for reasonable exploration and to yield meaningful results. Accordingly, the quantitative and qualitative data collection and analysis were designed and commissioned to adequately capture such complexity, and to ultimately contribute to practical applications for the case of project leadership. The results and analysis of the questions pertaining to leadership process and styles (refer to Figure 4.1) are succinctly presented hereinafter to demonstrate evidence on statistically significant correlations and to support the outcome from the QDA. The results include descriptive statistics, correlation scattering plots, and correlation heat maps. The results are also grouped against gender and geographic location. This allows the examination of leadership behaviour based on gender and geographic region as well. It is seldom found in literature that a a single study consolidates leadership styles, gender, and region to investigate the influence of gender and cultural dimensions on project leadership in the engineering industry.

It shall be emphasised that the statistical analysis presented below is not meant to be exhaustive, and only aims at establishing sensible interpretations of the quantitative results. In this respect, the primary objective, as explained in the Chapter 3, is to support the findings from the qualitative analysis. The SAQ questions pertaining to leadership process and styles are concisely summarized in Table 4.10 below. The description against each question is a short form of the full text found in the SAQ. Clearly, some questions under Leader Process and Leader Styles are deliberately interlinked for the purpose of establishing further coherence, reliability, and validity in the responses. Although the research does not seek rigorous statistical correlation analysis between pairs of questions, correlation was still employed to infer about the logical relationship between the responses; hence to obtain a sense of comfort about the causality between the independent and dependent variables. Further investigation and analysis of causality is established based on the QDA as described in Section 5.

Table 4.10

Summary of SAQ questions on leadership process and styles

Leadership Process	
Q22	Project leaders usually use systems thinking when thinking about project elements
Q23	Leadership shall be tailored to account for the dynamic nature of modern projects
Q24	Leadership styles suitable for large global in-person teams are also applicable to virtual teams
Q34	In global projects, a leader can simultaneously adapt to multiple leadership styles

Leadership Styles	
Q2	Leadership style(s) shall be consistent over the project life-cycle regardless of team size, competency, or complexity
Q3	Changing leadership style(s) might be perceived as lack of direction or confidence
Q8	Switching between leadership styles is justifiable based on situations and team characteristics
Q12	Setup of rewards upfront will motivate team members to perform and meet project objectives
Q16	Would you promote leadership among team members instead of being task-focused
Q17	In crisis situations, a leader shall still empower team members and not be exclusively directive
Q37	A project leader can be authoritative and supportive at the same time
Q38	A project leader should coach team members regardless of their experience and seniority level
Q39	A leader should always lead by example during complicated situations
Q40	In complex and risky projects, a leader may empower his/her team and become less directive if trust is built

The descriptive statistics associated with the responses to the questions in Table 4.10 are summarized in Table 4.11. Clearly, there is high level of agreement on the need to adapt leadership styles based on contingent factors (variables) such as team characteristics and project complexity. The corresponding questions, with high average score above 4.0, are highlighted in Table 4.11. The leader adaptation behaviour comprises two approaches, namely switching between leadership styles one at a time or assuming multiple leadership styles simultaneously. The latter is expectedly more sophisticated and requires considerable experience and people's skills.

Table 4.11

Descriptive statistics for leadership process and styles questions

Question	Mean	Std Dev	Min	25%	50% (Median)	Max
Q22	2.520	0.910	1	2	2	4
Q23	4.560	0.650	3	4	5	5
Q24	4.620	0.640	3	4	5	5
Q34	4.300	0.640	3	4	4	5
Q2	1.650	0.600	1	1	2	3
Q3	3.290	1.100	1	2	3	5
Q8	4.330	0.550	3	4	4	5
Q12	3.820	0.690	2	3	4	5
Q16	3.250	0.850	1	3	3	5
Q17	3.130	1.000	1	2	3	5
Q37	4.270	0.690	2	4	4	5
Q38	3.770	0.990	2	3	4	5
Q39	4.410	0.570	3	4	4	5
Q40	3.560	1.010	1	3	4	5

The correlation between questions that inherently reflect situational leadership is presented hereafter. For example, respondents who generally agreed that leadership shall be tailored to cope for the dynamic nature of engineering projects also agreed on the need to adapt leadership styles based on team characteristics and the specific circumstances of the project. Likewise, respondents concurred that assuming simultaneous leadership styles such as directive and supportive. The correlation between the response is depicted in Figures 4.10 and 4.11.

Figure 4.10

Correlation between tailored leadership (Q23) and switching between leadership styles (Q8)

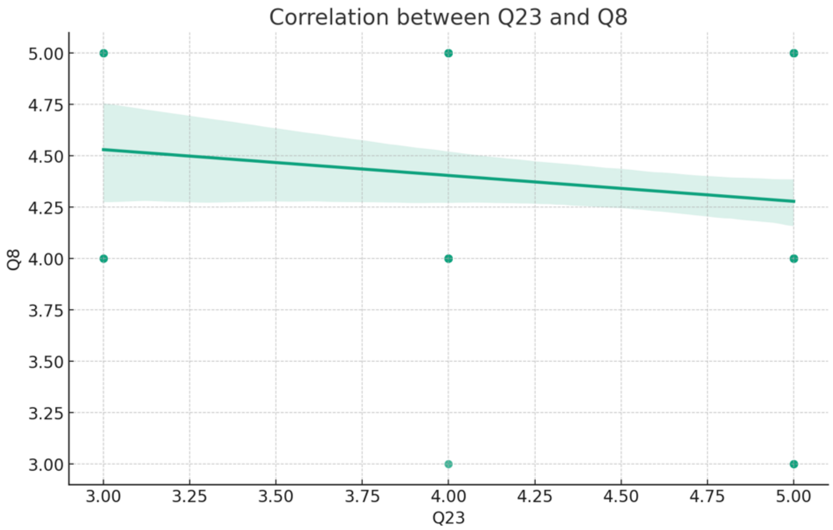
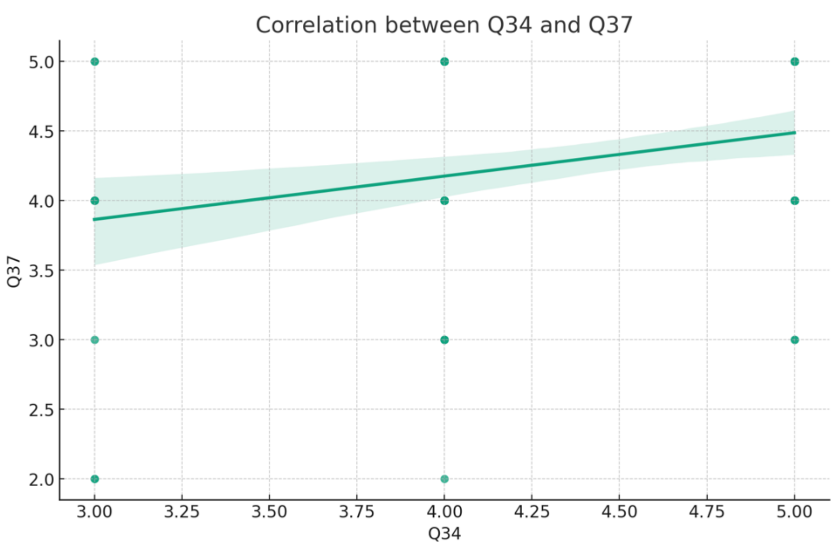


Figure 4.11

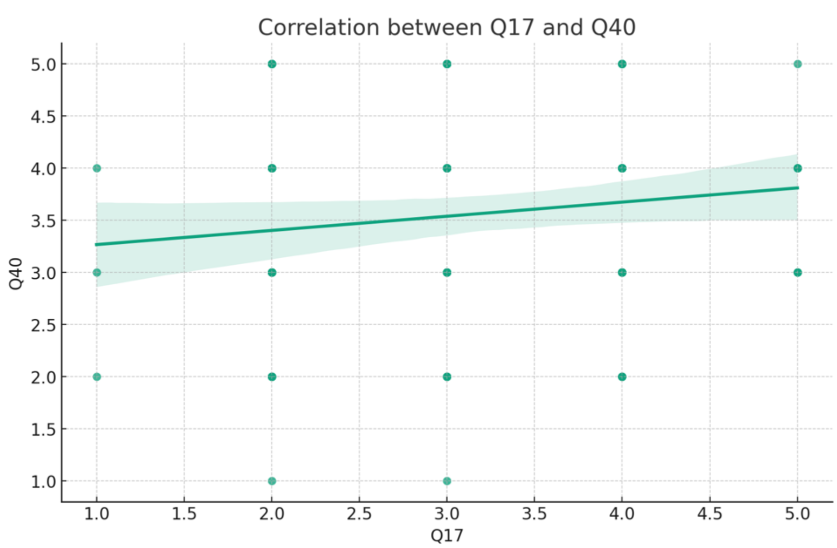
Correlation between simultaneous leadership (Q34) and assuming authoritative and supportive styles (Q37)



In contrast to the general agreement on the applicability of situational leadership, the responses showed neutrality towards less directive leadership behaviour in crisis situations. It is quite common to encounter distressing situations and underperformance in the engineering and construction industry. This often puts project leaders under pressure to meet aggressive deadlines under stringent conditions. In such situations, project leaders might not have the privilege to empower subordinates, therefore they tend to exhibit more directive leadership styles to keep team performance under control. Relatedly, the responses showed neutrality to questions Q17 and Q40 with an average response score of 3.130 and 3.560, respectively. Figure 4.12 illustrates the correlation between the responses of Q17 and Q40. The trend shows that respondents held similar opinions about the need for more authoritative leadership attitude in crisis and complex situations notwithstanding the trust built between the leader and the followers.

Figure 4.12

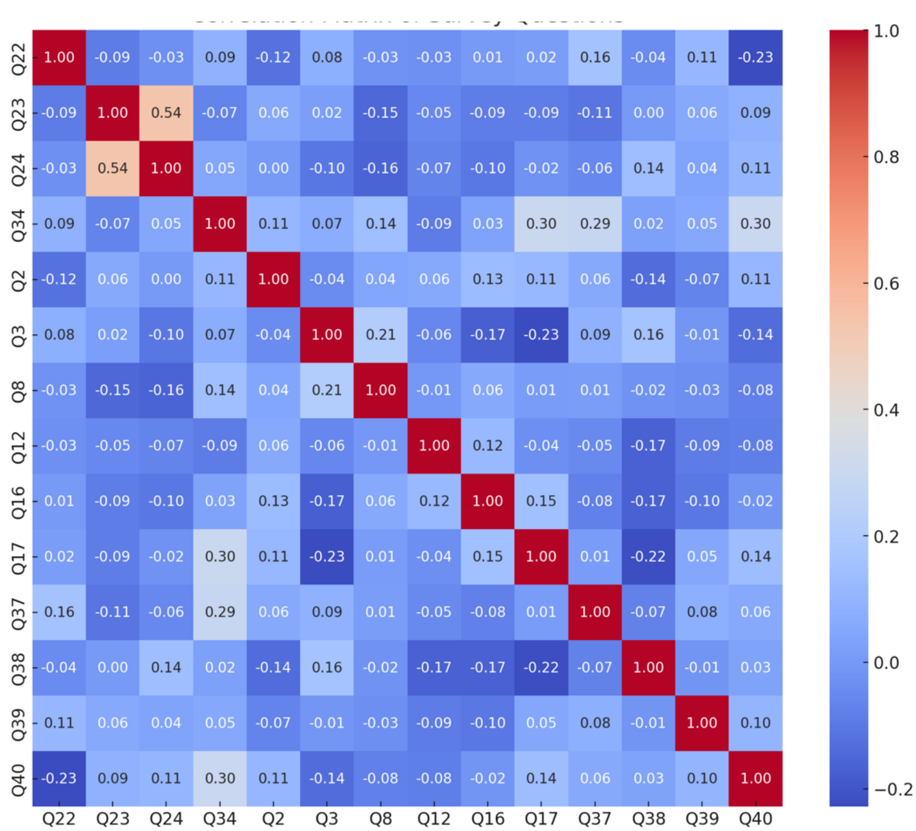
Correlation between team empowerment in crisis situations (Q17) and becoming less directive in complex and risky projects upon build of trust (Q40)



The logical relationship between the responses is further portrayed in the correlation heatmap matrix shown in Figure 4.13 below. It can be concluded that the simultaneous adaptation of leadership styles (Q34) has positive correlation with assuming an authoritative and supportive leadership styles (Q37) and the exhibition of more directive leadership style in crisis situations and for complex risky projects (Q17 and Q40). Whereas, changing leadership attitude by empowering subordinates in a time of crisis might be perceived as lack of confidence on the project manager's side as depicted in the negative correlation between Q3 and Q16. This could imply that a project leader should preferably maintain his/her leadership style particularly in time of crisis to avoid misperception by subordinates of inability to be a competent leader.

Figure 4.13

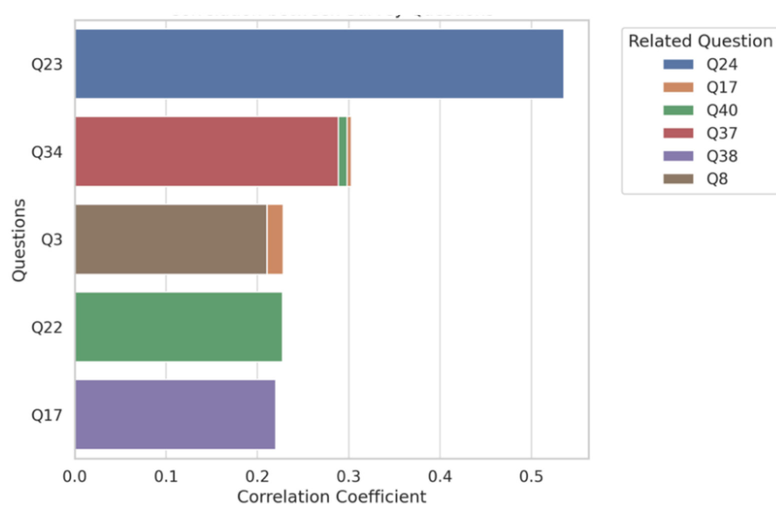
Correlation matrix (heatmap) for survey questions on situational leadership



Further examination of the correlations is found in Figure 4.14 which displays a filter out of the highest degree correlations. The highest correlation coefficient is observed between Q23 and Q24 which reveals consensus on the justification of situational leadership and its independence of the project team location whether in-person or virtual. There is no evidence on adequate scholarly research on the latter aspect. In other words, there is no support on whether a project manager's leadership style warrants adaption when teams become virtual. Comparatively, results in the QDA show that some specific situations, when running virtual teams, require adoption of more directive styles to allow team control. The positive correlation between Q17 and Q38 presents an interesting case since it exemplifies, to some extent, that leadership and coaching is not contingent to seniority level. Basically, a project leader may decide to exhibit more directive leadership styles in crisis situations and still coach both junior and senior engineers to improve performance. The implications of leadership in crisis situations and for complex projects substantially proves a paradigm shift in leadership behaviour and attitude under extreme circumstances. This aspect is thoroughly discussed in Chapter 5.

Figure 4.14

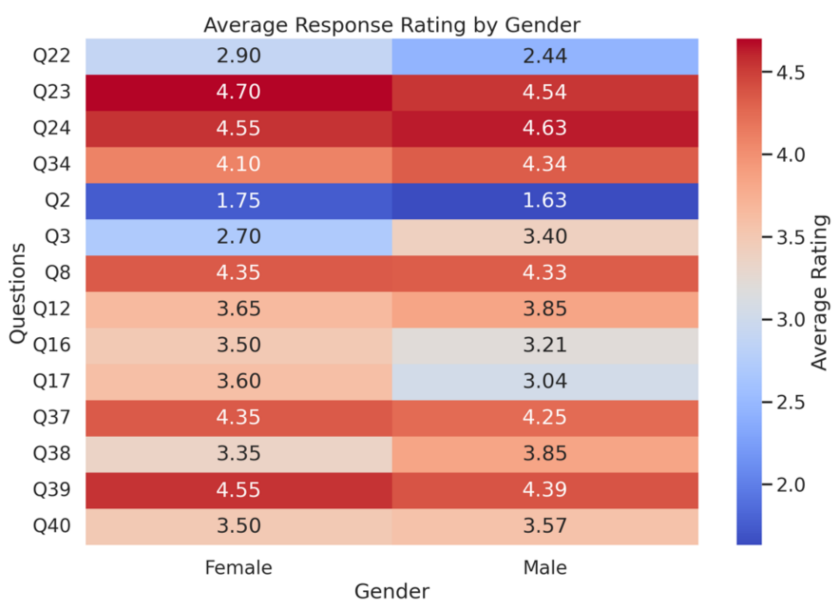
Highest degree correlation between responses on leadership process and styles



Additionally, the gender effect on leadership process and styles was examined as shown in Figure 4.15. The results revealed remarkable congruence between opinions held by male and female project leaders towards situational leadership behaviour, attitudes, and styles. Evidently, the results showed that there is no difference in the attitude, between male and female project leaders, in relation to agreement on the need to switch leadership styles situationally, and on being more directive in crisis situations. The stark comparison between the average response score in Figure 4.15 for nearly all questions is compelling evidence that the depend variable, namely leader styles, is independent of the project leader's gender.

Figure 4.15

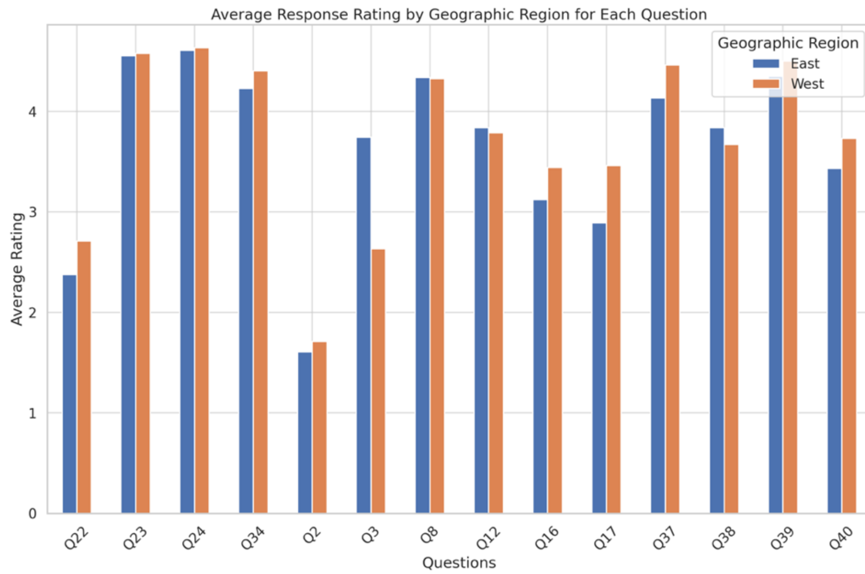
Grouping of responses to leadership style questions based on gender [Similar investigation was undertaken regarding the geographic region].



Generally, it could be claimed that there is good agreement among western and eastern project leaders about the underlying concepts of situational leadership as illustrated in Figure 4.16. Although scholars might argue that some national cultures, in the east, have different power and authority scale, the globalization and modernization of the engineering industry, and globalization of teams, and the shifts in the markets have recently rendered little differences between the west and the east. For instance, a project manager in US may lead a global team with members from western and eastern geographies. Likewise, a competent project manager from the Middles East could lead a global team with members from western and eastern regions. Both project managers would perceive leadership attitude in the same manner regardless of national culture. Perhaps the cliché that the world has become a small village resonates with the aforesaid findings. Therefore, it can be deduced that there is no significant influence of the geographic region on leadership behaviour, particularly for complex projects and crisis situations. Similarly, leaders from both the western and eastern regions appear to conceive team empowerment and rewarding in the same manner. This was also evident in the elaborations obtained in the interviews as shown the next section. Notably, the only question for which there was a less agreement from the western regions is Q3. Eastern engineers have more tendency to agree that if a project leader changes his style during crisis situations, then followers might perceive such change as a weakness. Unlike responses from the eastern offices, the western respondents less agreed to such hypothesis.

Figure 4.16

Grouping of responses to leadership style questions based on geography



The combined analysis of responses based on gender and geography is presented in Figure 4.17 below. For each survey question, the chart shows response grouping by gender and by geography to enable more thoughtful contemplation of the dependency between gender and national culture on leadership behaviour and styles. Most importantly, project leaders from western origins were selected to represent western geographies in the survey. This was crucial to avoid inadvertent bias in the responses. For instance, some project leaders, from eastern national origins, could be employed by offices in US, UK, and Europe. These responds are likely to represent eastern thoughts, principles, religious beliefs, and values, unless originally born and raised in the west. Nevertheless, it is advisable to avoid the bias by selecting western project leaders to represent western regions.

Figure 4.17

Grouping of responses to leadership style questions based on gender and geographic region

4.5 Qualitative Analysis Results

This section outlines the results of the qualitative data analysis (QDA) by summarizes the identified patterns, developed themes on leadership behaviour, and the cross checking with the quantitative data. The interview endeavour has been a continuous learning process with several lessons for future research as described in Chapter 5. Asynchronous and fact-to-face semi-structured and unstructured interviews were conducted with senior project managers and directors from western and eastern offices. The participants were selected using non-probabilistic purposive sampling, using multi-criteria approach, in order to obtain the most relevant data. Danial and Misnan (2023) conducted face-to-face and online semi-structured interviews with eight certified civil engineers, from the Public Works Department Malaysia, to investigate leadership skills that contribute to creativity and problem-solving in road projects. The participants were purposively selected in order to meet the objectives of the study. The sample's population represented the global project management community at the case study engineering firm which is spread across western and eastern geographies. The western geographies included Canada, United States, UK, and Europe. The eastern geographies included offices from the Middle East such as Saudi Arabia, Qatar, and UAE. The participants were senior engineers (project managers) with backgrounds from different engineering market sectors such as civil infrastructure, water resources, environment, transportation, and buildings, among others. Many of the senior project managers lead global projects which consist of teams from western and eastern offices in addition to offshore design centres in Philippines and India. Therefore, the population, and sample thereto, offered a rich and relevant source of data on project leadership. The participants consisted of male and female project leaders, although the sample predominantly included male participants. Interviews with western participants were carried out asynchronously using Microsoft Teams which offers video chat, audio-recording and automatic transcribing of the conversations. The criteria for participants selection were based on many parameters as summarized in Table 4.12. The final number of participants was 27 compared to the planned one of 30 (i.e. 3 nos. apologies due to different reasons including commitments).

Table 4.12

Selection criteria of interview participants

Criteria ID	Description	Selection Criteria	Remarks
C1	Gender	Male and female project leaders	25 M: 2 F
C2	Geographic region	Western and eastern offices	6 nos. global offices
C3	Years of experience	seniority level above +10 years	as per CV
C4	Minimum no. of projects	5 nos. aggregate ongoing or completed projects	Status of projects as per record
C5	Project manager category	4 or 5 as per proprietary categorization policy	Corporate policy
C6	Average team size (nos.)	10 nos. in-person or virtual teams	relative to project size
C7	Project complexity (monetary value)	$1.0mn for design, and $50mn for construction	other complexity factors were considered
C8	Engineering market sector	Infrastructure, transportation, buildings, and environment	Some projects are multi-disciplinary

Criteria C4, C5, and C7 presented the most challenging part of the selection process. The identification of the number of ongoing or completed projects (C4), under the management of the selected project leader, was carried out through assistance from the global projects director (i.e. the Guardian) and corporate records on backlog and completed projects. The status of the ongoing or completed projects was not retrieved due to confidentiality. For example, it did not matter if an ongoing project was meeting its objectives or under distressed conditions such as budget or programme related issues. Relatedly, the interview questions did not attempt to uncover any information about the performance status of the project although troubled projects normally offer rich data on lessons learned in leadership as per the author’s experience. The project manager’s category was easily facilitated using corporate ERP system which has the designation of the project manager. In this respect, only project managers who are categorized as 4 could run relatively large and complex project, while category 5 managers were usually appointed to quite large and complex global projects. The categorization of the project managers consists of several qualification criteria including years of experience, past record, technical competency, internal interview, and international certifications in project management. As such, the categorization itself, being 4 or 5, offered help in satisfying the selection criteria C3, C4, C6, C7, and C8 in some ways. The project's complexity is one of the independent variables in the theoretical framework and can be satisfactorily controlled by selecting projects with complexity levels commensurate with the objectives of the study. Therefore, criterion C7 was dedicated to project complexity to ensure that the selected project managers have been leading complex project. The multi-disciplinary nature of projects, technical complexity, in addition to the monetary value in US dollars were primarily relied upon to judge the suitability of project complexity. As further seen hereinafter, project complexity is not only essential for selection of project leaders but also offers abundant data on situational leadership, diversity of team members, and leadership in times of crisis for troubled projects. Additionally, further assessment of project complexity was undertaken during the interview to identify the complexity dimensions of the projects. This proved enormously helpful for the development of themes relevant to project leadership versus complexity. The employed tools, used to assess complexity, included ubiquitous tools such as the Complexity Assessment Questionnaire (PMI, 2014) and the Work Breakdown Structure (WBS) which is a hierarchical breakdown of a project's packages (Pinto & Slevin, 1988). Some other tools used to different extent include the Critical Path Method (CPM) and the Engineering Complexity Scale (ECS). The interview session lasted for thirty to forty minutes on average, with some interviews further extended using probing and unstructured open-ended questions. The interview transcripts were manually reviewed and cleaned to ensure corrections (i.e. transcription errors by the tool) thereby avoiding any loss of important data. The data was secured, and participants were made anonymous as described in Chapter 3. The transcript (interview narrative) was assigned to a unique designation according to a pre-determined standardized naming convention. The naming convention included subscripts, each has two numeral or alphabetic fields, to help in the identification of the participant's serial number, gender, geography, market sector, and project type (e.g. ID-Gender-Region-Sector-Project Type) without compromising the identity of the participants or the anonymity and confidentiality of the information. The selected participants are listed in Table 4.13 showing designations. The serial numbers were not sequentially ordered based on certain criteria but merely appear in the list based on the chronology of the interviews following the availability of the participants and the planned schedule of interviews.

Table 4.13

List of interview participants with assigned designations

Serial No.	Participant Designation	Market Sector	Project Type	Country
1	01-ML-ME-IF-DE	Infrastructure	Design	Middle East, Saudi Arabia
2	02-FE-ME-EV-DE	Environment	Design	Middle East, UAE
3	03-ML-UK-RL-CN	Railway Transport	Construction	UK
4	04-ML-NA-IF-CN	Infrastructure	Construction	North America, Ohio
5	05-ML-UK-IF-DE	Infrastructure	Design	UK
6	06-ML-ME-BL-CN	Buildings	Construction	Middle East, Saudi Arabia
7	07-ML-ME-BL-DE	Buildings	Design	Middle East, UAE
8	08-ML-NA-BL-CN	Buildings	Construction	North America
9	09-ML-ME-IF-DE	Infrastructure	Design	Middle East, Qatar
10	10-ML-ME-BL-DE	Buildings	Design	Middle East, Qatar
11	11-ML-AU-BL-DE	Buildings	Design	Australia
12	12-ML-CA-BL-CN	Buildings	Construction	Canada, Ontario
13	13-ML-ME-EV-DE	Environment	Design	Middle East, Saudi Arabia
14	14-ML-UK-IF-CN	Infrastructure	Construction	UK
15	15-ML-UK-IF-CN	Infrastructure	Construction	UK
16	16-FE-CA-EV-DE	Environment	Design	Canada, Ontario
17	17-ML-ME-IF-DE	Infrastructure	Design	Middle East, Jordan
18	18-ML-ME-IF-DE	Infrastructure	Design	Middle East, Jordan
19	19-ML-ME-IF-CN	Infrastructure	Construction	Middle East, Saudi Arabia
20	20-ML-ME-TR-DE	Transportation	Design	Middle East, UAE
21	21-ML-ME-TR-DE	Transportation	Design	Middle East, Saudi Arabia
22	22-ML-NA-IF-DE	Infrastructure	Design	North America, Florida
23	23-ML-CA-BL-DE	Buildings	Design	Canada, British Colombia
24	24-ML-EU-IF-DE	Infrastructure	Design	Europe, Germany
25	25-ML-EU-EV-DE	Environment	Design	Europe, Netherlands
26	26-ML-NA-TR-DE	Transportation	Design	North America, NYC
27	27-ML-ME-BL-CN	Buildings	Construction	Middle East, Saudi Arabia

The narrative of the interviews was analysed using content analysis and thematic analysis which are two distinctive methodologies used for the analysis of qualitative data to obtain in-depth information and understanding of social phenomena. The research focuses on thematic analysis for the development of sub-themes and themes, whereas content analysis is used heuristically to inform about the strength of an idea or theme through the systematic quantification and categorization of textual information (Krippendorff, 2018). On the other hand, Braun and Clarke (2012) describe thematic analysis as a more flexible, interpretive approach focusing on identifying patterns within qualitative data. Both methodologies are both valuable in qualitative research particularly for analysing interviews despite the cited challenging and weaknesses. For example, Fama et al. (2022) used thematic analysis of interview data to study difficulties in people with aphasia. Schreier (2012) emphasises the structured and quantifiable nature of coding in content analysis, where codes are often established in advance. On the other hand, Braun and Clarke (2006) describe the process of thematic analysis as more fluid, with codes and themes developing during the analysis, allowing for a richer, more nuanced understanding of the data.

The selection between content and thematic analysis depends on the research questions, the nature of the data, and the objectives of the study. The process of using content and thematic analysis is driven by coding of data extracts. The coding process aims at identifying features of data at sematic and latent levels (Braun & Clarke, 2006). It is worth noting that the evident variation in the terminology used in measuring the quality of research results extends to qualitative analysis methods as well. For instance, Humble and Mozelius (2022) claim that content and thematic analysis are often used interchangeably in qualitative analysis with subtle differences which makes the selection of one over the other rather peculiar.

In content analysis, coding is more systematic and quantitative. It involves defining specific codes before the analysis begins, often based on theory or existing research. The focus is on identifying and counting the frequency of specific words, phrases, or concepts. The researcher might pre-define codes like "work-life balance," "productivity," or "communication challenges." Each mention of these terms in the interview transcripts is then counted. This method allows for quantifying how often certain topics are mentioned, offering a measurable insight into the prevalence of certain themes.

In contrast, thematic analysis is more interpretive and flexible. In this respect, coding was performed using prescribed codes and also inductively; where codes are developed as the researcher reads through the data. This approach allows a more holistic and thorough analysis of qualitative data. In the latter, themes emerge organically from the data without being constrained by pre-defined categories. Some accounts cite a practical number of codes in the region of 35 to allow feasible analysis (Chakrabarti & Frye, 2017). Some themes emerge through the analysis process. For instance, many participants talk about the blurred lines between leadership and management, leading to the theme "leadership-management interface." This theme was not pre-defined but emerged from the data itself.

In summary, while content analysis focuses on quantifying pre-defined elements within the data, thematic analysis is more about exploring the data in-depth, allowing themes to emerge naturally. The choice between these two methods depends on the research objectives and the nature of the data being analysed. Content analysis is essentially a systematic and objective (deductive) means of describing and quantifying phenomena from textual data. As an analytical approach to qualitative analysis, it allows researchers to sift through large volumes of data with the aim of identifying recurring words, themes, events, or concepts. This method nearly accords to the conventional scientific method for testing hypotheses (Lancaster, 2005). Although content analysis can arguably be useful to identify recurring themes, it still lacks the effectiveness in offering in-depth understanding of the nature of data (Ozuem et al., 2021).

The implemented units of analysis were based on existing theory and the theoretical framework. The processual steps which were systematically adopted in performing content analysis, to guarantee trustworthiness, are outlined below.

I. Review of the research questions to ensure that they clearly articulated, and expressly state, the aspects of leadership phenomena to be explored through the analysis.

II. Selection of a representative data sample (set of texts or transcripts) for the analysis.

III. Proper assignment of codes and grouping of codes.

IV. Development of categories, sub-themes, and themes.

V. Analysis of data by examining frequencies, patterns, and relationships among categories. And, filtering out of ‘stop words’ which do not substantively contribute to the identification of patterns and themes (Chakrabarti & Frye, 2017).

VI. Finally, reporting the findings in a clear and structured manner.

Thematic analysis is more interpretive and flexible in comparison with content analysis. The flexibility of thematic analysis is exemplified in its applicability to a wide range of theoretical approaches and compatibility across a range of epistemological stances (Braun & Clarke, 2006). Thematic analysis comes from the family of essentialism and constructivism within social science. It focuses on identifying, analysing, and reporting prevailing patterns and overarching themes within data corpus, sets, items, and extracts (i.e. moving from larger to smaller data size). Thematic analysis is less about quantifying and more about the in-depth exploration of data. The patterns and themes were identified using both inductive (bottom-up) and deductive (top-down) approaches (Braun & Clarke, 2006). The inductive approach is data-driven and employs coding without a frame of reference, preconceptions, or pre-determined codes attributed to the research questions or the theoretical framework variables. Nevertheless, coding in an inductive approach should not be entirely isolated from the epistemological principles of the research (Braun & Clarke, 2006). Comparatively, the deductive process is more "explicitly analyst-driven" and is associated with the theoretical interests (Braun & Clarke, 2006, p.84). Coding is the most important first step in the thematic analysis process. Coding is a repetitive process where codes can be generated, re-generated, re-grouped and merged, or discarded based on the progressive analysis and understanding of data extracts. The types of coding considered in the research are summarized below.

1. Inductive coding: inductive coding is data-driven, and codes emerge from the data without trying to fit it into a predetermined theoretical framework. It is useful for exploratory studies where the researcher seeks to understand the data from a fresh perspective without imposing theoretical expectations. For example, Braun and Clarke (2006) discuss inductive coding as part of thematic analysis in psychology, emphasizing its flexible approach that allows for themes to surface from the data itself.

2. Deductive coding: contrary to inductive coding, deductive coding starts with a set of pre-determined codes based on existing theory or the researcher's analytical framework. This method is applied when the study aims at testing theory or analysing data through the lens of a specific theoretical structure.

3. Semantic coding: semantic coding involves identifying themes based on the explicit or surface meanings of the data. Here, the analysis stays close to the data itself, focusing on what the participant has said with minimal interpretation by the researcher. Semantic themes are often descriptive and summarize the content of the data.

4. Latent coding: this approach looks for underlying ideas, assumptions, and conceptualizations that shape the semantic content of the data. It involves interpreting the deeper meanings and underlying patterns in the data, often reflecting broader social constructs or discourses.

5. Saliency analysis: proposed by Buetow (2010), saliency analysis enhances thematic analysis by assessing the recurrence and importance of codes, highlighting what is significant to the study's aims, even if it is not frequently mentioned in the data. This method helps in identifying crucial but perhaps less obvious patterns in the data.

6. Hybrid coding: A combination of various coding types, hybrid coding uses both inductive and deductive approaches, and sometimes semantic and latent coding, to fully explore the data from different angles. Xu and Zammit (2020) exemplify this in education research, showing how combining different coding strategies can provide a more comprehensive analysis. Fereday and Muir-Cochrane (2006) describe a hybrid approach of inductive and deductive coding, where they integrated data-driven codes with theory-driven ones.

These coding types serve different purposes in thematic analysis and are chosen based on the research questions, objectives, and theoretical framework of the study. Inductive and deductive coding methods align with exploratory or theory-testing research respectively, while semantic and latent coding deal with the depth of data interpretation.

Saliency and hybrid coding offer nuanced approaches to handle the complexity and richness of qualitative data. As such, the most suitable approach for the current study was to implement hybrid coding to fully and meticulously navigate the qualitative data on leadership phenomenon.

The following steps were followed while conducting thematic analysis to improve trustworthiness of data analysis.

I. Familiarization with data corpus and immersion in the details, noting initial ideas, and re-reading of interview transcripts and hand notes.

II. Generating initial codes in a systematic fashion. A pre-determined set of codes, driven by the theoretical framework, is used to map the data to these predetermined codes. On the other hand, open coding allows the researcher to explore the data freely, without predefined categories, enabling them to identify and develop themes directly from the data. Codes are both denotative and connotative. Embrace recursion in the coding (Chenail, 2012b). Demarcating an undivided meaningful element or piece of data, that can be potentially used as a unit of analysis in qualitative research, is deemed as the most challenging task during the analysis process (Chenail, 2012a). The bits of data, that have qualitative significance, are subsequently coded and juxtaposed into evidence-based knowledge that helps in developing insights and interpreting the aspects of the phenomenon being investigated. Chenail (2012b, p.249) points out that the codes should ideally epitomize the qualitative substance of the data by providing a "perspective on that which is being coded". Metaphorically, it is like revealing something in terms of something else, and such approach of meaningful abstraction gives qualitative data analysis its value (Chenail, 2012b). To this end, whether it is the mere paraphrasing of interview quotes or a quantitative description of frequent chucks of raw data (e.g. words, phrases, etc), both do not reveal the distinct qualities of qualitative data hence do not constitute a qualitative data analysis process.

III. Collating codes into potential themes, at semantic and latent levels, and gathering all data relevant to each potential theme. The search could be based on settings (context), situations, patterns of behaviour, specific happenings (events and incidents), strategies (how people do things), relationships and interactions, and consequences. Examining conceptualizations and assumptions was conducted during this step to inform the theoretical underpinnings of the theoretical framework. Codes, themes, and sub-themes were hierarchically tabulated and visually organised using thematic maps.

IV. Review of themes to verify whether such themes align with the coded bits of data.

V. Developing a detailed analysis of each theme.

VI. Recursively correlating the qualitative analysis to the research questions, theoretical framework, and relevant scholarly literature.

The recurring evidence-based themes, obtained from thematic analysis, enable the extraction of phenomenon related information and nuanced insights, which essentially contributes to a more robust understanding of theory in addition to the development of new theory such as the case in grounded theory (Braun & Clarke, 2019). Accordingly, qualitative research allowed researcher to delve into the complexity of leadership phenomenon by embracing and capturing the context-specific nature of leadership in different contexts. Such holistic and contextualized perspective further facilitates the capturing of the complex multifaceted nature of leadership. The systematic and rigorous approach of coding, identifying categories, sub-themes, and overarching themes is considerably suitable for exploratory research and theory development, particularly for the case of complex social phenomena (Braun & Clarke, 2019; Braun & Clarke, 2014; Byrne, 2022). Schreier (2012) emphasises the structured and quantifiable nature of coding in content analysis, where codes are often established in advance. On the other hand, Braun and Clarke (2006) describe the process of thematic analysis as more fluid, with codes and themes developing during the analysis, allowing for a richer, more nuanced understanding of the data.

The research predominantly employs manual coding and theme development. The choice between manual and computer software is highly controversial. Manual analysis offers full control and minimizes the chances of overlooking patterns, sub-themes, and themes, especially when codes are encapsulated in data rather than being in-vivo. Manual coding allows researchers to actively, and meaningfully, delve and permeate into the data thereby getting more insights and retrieving in-depth semantic and latent underlying themes for multi-faceted phenomena (Ozuem et al., 2021).

Computer-assisted data analysis software has been gaining popularity for performing thematic analysis due to their speed and reasonable accuracy. Although computational text analysis tools facilitate traditional automated qualitative analysis of large corpora, Chakrabarti and Frye (2017) point out that such tools should be complementary to subjective manual analysis and theorizing; and should not entirely replace the researcher’s systematic in-depth analysis that leads to the discovery of patterns and themes; which is central to successful qualitative analysis. The use of software has also increased due to the complexity of qualitative analysis and the laborious efforts needed to analyse large text data. Furthermore, computational text analysis predominantly relies on pre-determined codes which often are laborious to replicate. Atherton and Elsmore (2007) presented an account to showcase the with and against computer-assisted qualitative data analysis tools (CAQDAS) in management research. Their analysis shows ambivalent opinions and critical debates on the utilisation of CAQDAS. On one hand, concerns are mainly driven by the risks associated with their contextual effectiveness in identifying the underlying interactions and epistemological embedded meanings for complex multi-faced social settings. On the other hand, such computer-based analytical tools can offer more rigor and robustness in relation to data management and modelling to arrive at better validity of text analysis (Atherton & Elsmore, 2007; FUCHS, 2023). Proponents of computer-assisted coding suggest that such tools be helpful for processing large volume of data but should merely be used as an assistive tool (Brod et al., 2009). Therefore, it is not uncommon that some scholars still focus on structured and rigorous analysis, performed manually, to stimulate synthesis and sense-making whilst selectively seeking assistance from qualitative analysis software (Atherton & Elsmore, 2007; Bergin, 2011). It is therefore argued that the use of manual analysis is greatly beneficial for the scrutinization of data to discover nuances complexities (Williams & Moser, 2019). The interview questions are outlined hereafter and mapped to the research questions and the theoretical framework in a similar fashion to the mapping of the survey questions presented in the previous section. This mapping facilitates the analysis and correlation of themes with the research questions and the variables of the theoretical framework. The mapping is shown in Table 4.14. The mapping employs keywords, rather than inserting questions verbatim, for convivence of presentation in a tabulated format. It should be noted that research question no. 1 is general and not directly linked to the theoretical framework variables. However, it could to some extent be related to research question I through probing. In this respect, the interview question asked the participants about their opinions on the importance and contribution of leadership in the successful delivery of projects. Indirectly, the question is looking at whether strong management, not leadership, is enough to delivery engineering projects. The probing utilised some sub-questions on the aspects of leadership, which the participants think, is not addressed in leadership courses and training. Further, leadership process is placed under the dependent variables although this is not entirely accurate. The leadership process has a dichotomous nature since it can be regarded as the black box, inside which leadership styles manifest, and can concurrently be conceptualized as a dependent variable as depicted in Figure 4.18.

Table 4.14

Mapping of interview questions to research questions and theoretical framework

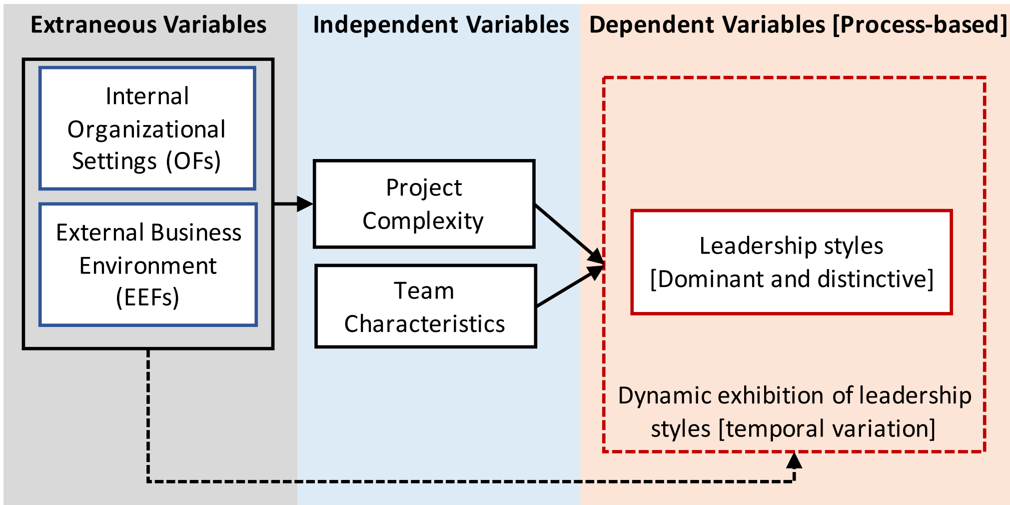
Interview Question	Theoretical Framework: Independent Variables	Theoretical Framework: Extraneous Variables	Theoretical Framework: Dependent Variables	Research Questions*
1	***	***	***	I
2	***	***	Leadership styles	II, III
3	Project complexity	***	Leadership styles	II, III
	Team characteristics	***	Leadership styles	
4	Project complexity	***	Leadership styles	II, III
5	Team characteristics	***	Leadership styles	II, III
6	***	Internal organizational settings (OFs)	Leadership styles	II, III
7	***	Internal organizational settings (OFs)	Leadership styles	II, III
8	Team characteristics	***	Leadership styles	II, III
9	Team characteristics	Internal organizational settings (OFs)	Leadership styles	II, III
	Project complexity	External business environment (EEFs)	Leadership process	
10	Team characteristics	***	Leadership styles	II, III
11	Project complexity	External business environment (EEFs)	Leadership process	II, III, IV
12	***	External business environment (EEFs)	Leadership process	I, III, IV
13	Team characteristics	Internal organizational settings (OFs)	Leadership process	I, III, IV
	Project complexity	External business environment (EEFs)		

Research Questions Guide (short-form):

I	Research gaps, lack of multi-dimensional conceptualization of leadership phenomenon in the engineering industry
II	Dominant and distinctive leadership styles exhibited by engineering project managers who run large complex projects
III	Dynamic leadership by either assuming or switching between multiple leadership styles over the project's life cycle
IV	Formulation of a substantive leadership model of practical relevance to engineering project leaders based on research findings
***	*Not related*
(*)	*All interview questions are indirectly linked to research question IV although not entirely shown in the table*

Figure 4.18

Theoretical framework – leadership as a dependent variable and process



As clearly shown in Figure 4.18, the extraneous variables are linked to one independent variable: namely, project complexity. It is also hypothesized that the extraneous variables have a mediation effect on the leadership process. The conceptualization of leadership as a dynamic process-based phenomenon ensues the treatment of the leadership process as both a latent variable and a dependent variable at the same time. As a dependent variable, the research essentially seeks to find the dominant and distinctive leadership styles exhibited by project leaders who run complex projects. The dominant leadership styles are believed to be the manifestation of a time-varying leadership process, with perhaps other leadership styles exhibited by the project leader. Therefore, it is legitimate to extend the abstraction of the dependent variable thereby assuming leadership process as a dependent variable as well. Although the previous model construction is intrinsically complicated and difficult to pursue through a standalone doctorate study, it is still argued to be necessary for a meaningful comprehension of the leadership phenomenon that adequate for building a substantive model of practical relevance to engineers.

The presentation of qualitative data analysis hereinafter, using content and thematic analysis, is based on focused and strategic approach. Simply, the chapter does not include dumping of all qualitative data and relevant data extracts and quotes but strategically portrays the most important data and results that are pivotal to the research. For instance, quotes are selectively truncated and presented to convey the broader picture of the results and developed themes. The presentation of the results starts by showing the coding approach and results, then the discussion transitions to code grouping, discovery of patterns, establishing sub-themes, and ultimately theme development. As mentioned earlier, coding was performed manually with assistance from bespoke script in Python.

Content analysis was used to heuristically examine the factors linked to the variables in the theoretical framework. For example, project complexity comprises several aspects including technical, institutional, stakeholders, political, among others. As such, content analysis was used to measure the frequency of occurrence of codes driven by such aspects. Similarly, team characteristics encompasses traits, competency, loyalty, dynamics, location, among others. Therefore, it would be helpful to obtain insights through the calculus of codes linked to such underlying structures of the variables. Essentially, the measurement and analysis of occurrence may give an indication on the weight of each aspect (i.e. sub-variable) connected to the independent, extraneous, and dependent variables. Although such content analysis is not beneficial when looked at in isolation, it could still offer some insights when studied in conjunction with the results obtained from the thematic analysis. Therefore, content analysis was not exhaustive and employed simplistic descriptive statistics and representation of data as described hereafter.

The identified dimensions of independent variables were investigated using content analysis to determine the weight of influence of each dimension. Such identification was later used for the formulation of the substantive models. Said differently, an independent variable that encompasses several sub-variables will contribute to the leadership process based on the strength of each sub-variable. For example, the dimensions associated with complexity were identified as follows: technical complexity, multi-disciplinarity complexity, stakeholders network complexity, budget complexity, and programme complexity. The extraneous variables internal organisational settings (OPs) and external environmental factors (EEFs) are also linked to independent variable *project complexity* as depicted in the theoretical framework. Although some of the sub-variables might be linked to OPs and EEFs, there were purposely separated for convenience of analysis due to their appearance in the qualitative data. For example, it could be argued that stakeholder's environment complexity is deemed as part of EEFs; however, EEFs could include other aspects such as political forces or environmental restrictions. The treatment of an exhaustive list of sub-variables would be an onerous task. Therefore, the analysis was exclusive to the most important sub-variables according to the frequency of their appearance in the data. Similarly, the impact of the independent variable *team characteristics* was examined using three sub-variables according to their appearance in the data, namely: team size, technical competency, project management maturity level, and collaboration spirit. The dependent variable "*leadership styles"* was also investigated in a similar fashion in order to discover the relative weight of each leadership behaviour or style based on appearance in the interview narratives. The leadership behaviour and styles comprised authoritative, directive, supportive, coaching, active, passive, transformational, transactional, and empathetic style. Further, *leadership process* was navigated using the dimensions delegation, reciprocal influence, shared leadership, leadership conductivity, dynamic leadership, and concurrent leadership styles. Table 4.15 summarizes the results of the content analysis pertaining to the independent variables *project complexity* and *team characteristics*. The figure shows relative quantitative frequencies of the dimensions in addition to the codes associated with each dimension. The arithmetic summation of the relative frequencies is 100%. For the case of project complexity, the results show the relatively high weight associated with stakeholders' complexity in comparison with other complexity dimensions. Comparatively, the highest weights for the case of team characteristics were associated with team size and technical competency; being the most influential that impacts leadership behaviour and attitude

Table 4.15

Quantitative frequencies of independent variable and associated dimensions

Independent variables and sub-variables (dimensions)	Relative frequency %*	Codes associated with dimensions
Project Complexity		
Technical complexity	25	innovation, unique features, site constraints, scientific aspects, multi-disciplinary projects, systems thinking
Stakeholders complexity	30	power, influence, number of stakeholders, competing forces
Budget complexity	20	unrealistic budget, cost reduction, economic stress, stringent milestones
Programme complexity	25	unrealistic schedule, disruption, uncontrolled delays
Team Characteristics		
Team size	33	global teams, virtual teams, multi-functional, hierarchy, groups, sub-groups, team dynamics
Technical competency	36	technical experience, digital skills, software knowledge, experience with local standards and practices, innovation and creativity, education, professional chartership
Project management maturity	13	knowledge of project management practices, certification, compliance, processes and procedures, communication skills, correspondence skills
Collaborative spirit	18	communication effectiveness, cooperation, vision, common goals, conflict resolution, sharing of information, support and assistance, efficient meetings, delegation

(*) *relative frequency is approximated to zero significant digits*

Tables 4.16 summarizes the results for the dependent variable *leadership styles* and the quasi-dependent variable *leadership process*. The results clearly reveal the high relative weights of the authoritative and transformational leadership styles, and the combined weight for dynamic leadership and concurrent leadership styles in comparison with other process dimensions.

Table 4.16

Quantitative frequencies of dependent variables and associated dimensions

Dependent variables and sub-variables (dimensions)	Relative frequency %*	Codes associated with dimensions
Leadership Styles		
Authoritative | Directive	27	authority, command-and-control, instructions, follow me, do as I say, directions, rules, assigned tasks, compliance, conformance, team assignment, task reporting
Supportive	19	advice, assistance, lead by example, nurture, training, transparency, honesty, help to overcome underperformance, guidance, covering of team members
Active	9	timely advice, proactive, vision, eye-opening, directions, lead by example, early warnings, does not wait for mistakes, active engagement, team player
Passive	5	wait for mistakes to take place, no interaction, reactive, late engagement, step in the last moment, take a back seat, team to learn from mistakes, formal communication
Transformational	22	empowerment, advice, transparency, attentive to team needs, visionary, common goals, helpful, continuous guidance, honesty, knowledge sharing, team development
Transactional	3	bonus, time in-lieu, salary increase, credit, praise
Coaching	7	lead by example, training, professional development
Empathetic	8	attention to team needs, active listening, assistance, work from home allowance
Leadership Process (quasi-dependent variable)		
Delegation	16	delegate tasks, appoint leaders within the team, minimum advice, team growth
Reciprocal influence	12	team leadership, mutual understanding, mutual help, proactive interaction
Shared leadership	10	leadership conductivity, embedded leadership, distributed leadership, taking responsibility and ownership, frugality, sense of responsibility, accountability
Leadership conductivity	19	accountability, sense of responsibility, conductive environment, leadership of senior management, motivation
Dynamic leadership	25	change of leadership style, switching between leadership styles, transition, timely change of leadership attitude, change in leadership behaviour, adaptation, flexibility
Concurrent leadership styles	18	simultaneous, concurrent, assuming different styles at the same time, multi-style leader, versatile, wearing different hats, two-side brain, leader and teacher

(*) *relative frequency is approximated to zero significant digits*

Some examples are given hereafter to portray a broad view on the thematic analysis process and results. A summary of the results is then presented for all interview questions.

Question 1: In your opinion, to what extent leadership behaviour of a project manager directly contributes to project success in large and complex engineering projects?

The responses included data codes such as leadership qualities, project management challenges, team dynamics, and project success factors. The identified categories are listed below against each code.

1. Leadership qualities: vision and goal alignment, adaptability, cultural awareness, technical proficiency, communication skills, and decision-making. For instance, vision and goal attainment applied to statements emphasizing the importance of creating and communicating a clear project vision. For example, participant 04-ML-NA-IF-CN mentioned "creating a vision that aligns the team towards a common goal."

2. Project management challenges: navigating challenges, stakeholder management, managing legacy projects, regulatory compliance, and environmental factors. For example, stakeholder management is used for parts of the responses discussing how effectively managing different stakeholders influences project success. An instance is from 05-ML-UK-IF-DE discussing alignment of various stakeholders with differing priorities.

3. Team dynamics: innovation, efficiency, collaboration, maintaining morale, and multi-disciplinary team management. For example, innovation was tagged to segments where the importance of fostering innovation in project teams is mentioned, like in the case of the senior manager 07-ML-ME-BL-DE who focused on inspiring innovation in building design.

4. Project success factors: efficiency and quality, client satisfaction, safety and compliance, and balancing technical and artistic aspects. For example, participant 16-FE-CA-EV-DE clarified that ".. and client satisfaction is equally important as being on budget and schedule. Sometimes an upset client might be blinded by anger [you see] and will start picking on areas of poor performance even though the project can be a good one overall."

Examples of the identified patterns and developed themes are described below.

1. Role of vision in leadership: the majority of responses emphasised the importance of a clear vision for leading complex projects, indicating that successful project management is anchored in the ability to create and communicate a unifying goal.
2. Adaptability and cultural awareness: particularly noted by the Middle East and UK project managers, the ability to adapt to changing circumstances and understand diverse cultural contexts is crucial, suggesting that successful leadership in project management is highly dependent on context.
3. Importance of effective stakeholder management: across all regions, managing stakeholders effectively is seen as a key determinant of project success, highlighting the importance of aligning various interests and priorities in complex projects.
4. Balancing innovation with practical constraints: mentioned by both the Middle East and Canadian managers, the ability to foster innovation while adhering to practical and regulatory constraints is a critical leadership skill, indicating a need for leaders who can navigate between creativity and realism.
5. Leadership impact on team and project outcomes: common in all responses is the belief that leadership directly affects team dynamics, project efficiency, and overall

success, illustrating that the leader's behaviour and decision-making are central to project outcomes.

6. Challenges unique to each sector: each manager outlined challenges specific to their sector (e.g. infrastructure, buildings, rail) showing that leadership in project management requires sector-specific technical knowledge and good soft skills.

These themes collectively underline the multifaceted nature of leadership in project management, with an emphasis on vision, adaptability, stakeholder management, and balancing innovation with practicality, all of which are essential in navigating the unique challenges of different sectors and regions.

Question 3: Can you describe an event when you had to change your leadership style? What were the reasons behind that? Was project complexity one of the drivers for such change? Do you think team members characteristics played a role in this respect?

The senior project manager 08-ML-NA-BL-CN from the buildings sector stated,

"Certainly, there was a significant project I managed, involving the construction of a multi-use complex, which required me to adapt my leadership style. Initially, my approach was very hands-on and directive, as we were setting up the foundations of the project, dealing with numerous regulatory compliances, and facing tight deadlines. I needed to ensure that all team members were aligned with the project objectives and understood the critical path clearly".

As the project progressed into more specialized phases, especially when we were dealing with the architectural design and high-tech installations, I realized the need to shift my style. The complexity of these tasks required specialized knowledge that some of my team members possessed more than I did. At this juncture, I transitioned to a more participative and transformational leadership style. This change was driven partly by the project's complexity and the need for innovative solutions, which required tapping into the creativity and expertise of various team members.

The skills of the team members played a crucial role in this shift. As we moved into these specialized phases, I noticed that some team members who were highly skilled and experienced in their fields responded better to my leadership style that allowed them more autonomy and input into the decision-making process. They valued the opportunity to contribute their ideas and expertise. By adapting my leadership style to be more inclusive and collaborative, I was able to harness their skills more effectively, which significantly contributed to the project's success.

Truthfully [small pause] the change in my leadership style was influenced by both the complexity of the project and the evolving needs and strengths of the team. It was a learning experience that highlighted the importance of being adaptable and responsive to the demands of the project and the dynamics of the team."

The analysis below shows the identified codes and relevant categories that were used to discern overarching patterns and themes.

1. Leadership style adaptation: instances where the project manager describes changing their leadership approach.

2. Directive leadership: applied to the initial phase of the project where a hands-on, directive approach was used.

3. Regulatory compliance and deadlines: refers to the early project stages focused on meeting regulatory standards and tight deadlines.

4. Participative and transformational leadership: tags the later phase where the manager shifted to a more inclusive and empowering leadership style.

5. Complexity and specialization: applied to descriptions of the project's specialized phases that required distinct expertise.

6. Team member expertise and autonomy: refers to recognizing and valuing the specific skills and autonomy needs of team members.

7. Creative and innovative solutions: instances where the need for creativity and innovation in the project is mentioned.

8. Team dynamics and responsiveness: tags the manager's observations and adaptations to the evolving team dynamics.

Example of the relevant categories are briefly described below.

1. Leadership evolution and responsiveness: includes codes related to how the manager's leadership style evolved in response to project phases and team needs, such as leadership style adaptation, directive leadership, and participative and transformational leadership.

2. Project phase challenges and Requirements: covers aspects of the project that dictated different leadership approaches, including regulatory compliance and deadlines and complexity and specialization.

3. Team engagement and empowerment: groups codes that relate to engaging and empowering the team, like team member expertise and autonomy and creative and innovative solutions.

The corresponding prevalent and overarching themes are described below.

1. Adaptive leadership in response to project phases: a prominent theme is the adaptation of leadership style in response to different project stages. The manager shifted from a directive approach during the foundational phase to a more participative style in specialized phases, highlighting the importance of flexibility in leadership.

2. Importance of recognizing team expertise: the manager's shift to a more collaborative approach during complex tasks underscores the theme of recognizing and leveraging team expertise. This suggests that successful project management involves valuing and utilising the specific skills of team members.

3. Balancing directive and participative leadership: the manager’s experience illustrates the balance between directive and participative leadership styles, depending on the project's needs and team dynamics. This indicates that effective leadership in project management is dynamic and situational.

4. Responsiveness to team dynamics for project success: the manager’s ability to adapt their leadership style based on the team's characteristics and project requirements highlights the theme of being responsive to team dynamics, essential for harnessing team potential and achieving project success.

These themes collectively emphasise the significance of adaptive leadership in project management, especially in projects with varying complexities and specialized team member roles. The manager's experience demonstrates the value of being flexible, responsive to team needs, and open to changing leadership styles to optimize project outcomes.

Question 4: Some professionals argue that an authoritative leadership style is more suited for complex engineering projects that involve many stakeholders. What is your opinion on this?

Examples on the extracts of significance to the theoretical framework and research questions are given below.

05-ML-UK-IF-DE "I understand the rationale behind favouring an authoritative leadership style for complex engineering projects, especially those involving multiple stakeholders. The clarity and decisiveness that come with this style can be invaluable in aligning diverse groups towards common objectives and making swift decisions in high-stake environments. However, I believe that while authoritative leadership is useful in certain phases of the project, particularly during crisis management or when quick, decisive action is needed, it should not be the predominant style. Complex projects benefit greatly from collaboration, innovation, and diverse input, which an overly authoritative approach might stifle. In my experience, a balanced approach that combines the decisiveness of authoritative leadership with the inclusiveness of participative styles often yields the best outcomes. It’s about knowing when to assert authority and when to foster collaboration and input from various stakeholders."

12-ML-CA-BL-CN "In my opinion, an authoritative leadership style has its place in complex engineering projects, but it shouldn't be the default mode. While it's true that such projects, with their numerous stakeholders and high levels of technical complexity, require a strong hand to guide them, relying solely on an authoritative style can be counterproductive. It may lead to a lack of creative solutions and reduce team morale, as team members may feel their expertise and opinions are undervalued. Instead, I advocate for a situational leadership approach, where the project manager can adopt an authoritative style in situations that require clear direction and quick decision-making, and a more collaborative style when the project benefits from diverse input and team engagement. This flexibility allows for better handling of the complex dynamics of large engineering projects."

15-ML-UK-IF-CN "While I agree that authoritative leadership can be effective in managing the complexity and multiple stakeholder interests in engineering projects, I believe it's not sufficient on its own. Complex projects often involve innovative problem-solving and a high degree of technical expertise, where input from various team members and stakeholders can be invaluable. An overly authoritative approach might hinder this collaborative problem-solving process. Moreover, team dynamics play a significant role in project success. An authoritative style may not always be the best approach, especially with highly skilled and self-motivated teams. I think a more adaptive leadership style, which can fluctuate between authoritative, and collaborative based on the project phase, team composition, and specific challenges faced, is crucial for the successful management of complex engineering projects."

These responses reflect a nuanced understanding of leadership styles in complex engineering projects, emphasizing the importance of adaptability and situational awareness in leadership approaches. By analysing the responses from the senior project managers, codes were identified and categorized to discern overarching patterns and themes. The identified codes are shown below.

1. Role of authoritative leadership: instances where the value or function of an authoritative leadership style in complex projects is discussed.
2. Collaboration and team Input: applied to mentions of the importance of collaboration and considering team members' input.

3. Situational leadership approach: refers to advocating for adapting leadership style according to the situation or project phase.

4. Balance between authoritative and collaborative styles: instances where a balance between different leadership styles is emphasised.

5. Innovation and creative problem-solving: tags segments discussing the role of innovation and creative solutions in project management.

6. Team dynamics and morale: applied to mentions of how different leadership styles affect team dynamics and morale.

7. Flexibility in leadership: refers to the ability to switch between various leadership styles as per the project's needs.

8. Stakeholder management: instances where managing diverse stakeholder interests is mentioned.

The corresponding categories are briefly described below.

1. Leadership styles and their impact: includes codes related to different leadership approaches and their effects on project management, like role of authoritative leadership, collaboration and team input, and team dynamics and morale.

2. Adaptability in leadership: covers aspects of adjusting leadership style in response to project requirements, represented by situational leadership approach, flexibility in leadership, and balance between authoritative and collaborative styles.

3. Project management strategies: groups codes related to broader strategies for managing complex projects, including innovation and creative problem-solving" and stakeholder management.

The developed overarching themes are articulated below.

1. Necessity of a balanced leadership approach: a common theme across all responses is the recognition that while authoritative leadership has its merits, especially in crisis or decision-intensive phases, a balanced approach incorporating both authoritative and collaborative styles is more effective for complex projects.
2. Importance of situational flexibility: each manager highlighted the importance of situational adaptability in leadership. They suggest that the leadership style should vary depending on specific project phases, challenges, and team dynamics, indicating a preference for a flexible, situational leadership approach.
3. Collaboration for innovation and problem-solving: the majority of project managers emphasised the significance of collaborative approaches in fostering innovation and creative problem-solving, particularly in projects that involve high levels of technical complexity and diverse stakeholder groups.
4. Impact of leadership style on team morale and dynamics: there is a shared understanding that leadership style affects team morale and dynamics. An overly authoritative approach might demotivate teams, especially those with highly skilled members, suggesting the need for a leadership style that values and incorporates team input.

These themes collectively underscore the complexity of leadership in engineering project management, emphasizing the need for a balanced, adaptive leadership style that can effectively manage the intricate interplay of decisive action, team collaboration, stakeholder engagement, and innovative problem-solving.

Question 7: Can you briefly describe instances where the internal organisational structure of the firm worked against project performance? In what ways such structure was impeding? What did you do as a project manager to overcome the relevant challenges?

Examples on quotes of pivotal importance to the research questions and theoretical framework are furnished below.

09-ML-ME-IF-DE "There was an instance in a large-scale urban infrastructure project where the internal organisational structure of our firm posed significant challenges. The firm's hierarchical structure led to delayed decision-making processes, as approvals had to go through several layers of management. This rigidity hindered our ability to respond swiftly to project needs and adapt to changes. Additionally, there were silos between departments, which created communication barriers and inefficiencies.

To address these issues, I took a proactive approach. Firstly, I established a more streamlined communication protocol with upper management, emphasizing the need for quicker decision-making processes for critical project components. Secondly, I initiated cross-departmental meetings, creating an integrated team approach that facilitated better understanding and collaboration among different units. By fostering this culture of open communication and collaboration, we were able to mitigate the negative impact of the organisational structure on our project performance."

13-ML-ME-EV-DE "In one of our high-tech engineering projects, the company's rigid departmental structure became a major impediment. Each department operated in isolation, and there was a lack of collaborative spirit. This siloed approach caused delays in information sharing, leading to misunderstandings and redundant work.

To counter these challenges, I had to take an unconventional approach. I organised regular inter-departmental workshops and informal gatherings, fostering an environment where team members from different departments could interact and share ideas freely. I also worked with department heads to establish a more flexible workflow for the duration of the project, allowing for easier and more direct communication channels. These efforts helped break down barriers, leading to a more cohesive and efficient project team, and ultimately, a successful project outcome."

11-ML-AU-BL-DE "In a recent project, our firm's traditional, top-down organisational structure proved to be a significant obstacle. The structure limited the autonomy of the project team, constraining our ability to make on-the-spot decisions crucial for the project's momentum. The centralized decision-making process was time-consuming, which was detrimental in a project that required agility and flexibility.

To overcome this, I implemented a dual approach. First, I negotiated more autonomy for the project team with the senior management, highlighting the unique demands of the project. This autonomy allowed for quicker decision-making at the project level. Second, I established a smaller, dedicated decision-making team within the project, comprising key members who were empowered to make critical decisions. This approach enabled us to be more agile and responsive to the project's needs, significantly improving our performance."

Following on the responses from these senior project managers, some of the identified codes are shown below.

1. Organisational structure challenges: refers to mentions of difficulties due to hierarchical or siloed structures within the organisation.

2. Delayed decision-making: tagged to instances where slow decision-making processes are highlighted as a challenge.

3. Communication barriers: applied to mentions of issues arising from poor communication between departments or levels of management.

4. Proactive leadership: refers to instances where the project manager describes taking initiative to address challenges.

5. Collaboration and integration: tagged to descriptions of efforts to enhance teamwork and break down departmental silos.

6. Streamlining processes: refers to actions taken to make decision-making or communication processes more efficient.

7. Autonomy and empowerment: applied to descriptions of efforts to increase the independence and decision-making power of teams or individuals.

The corresponding categories are described below.

1. Internal organisational dynamics: includes codes related to the structure and internal functioning of the organisation, such as organisational structure challenges, delayed decision-making, and communication barriers.

2. Leadership and management strategies: encompasses the approaches and tactics used by project managers to overcome challenges, including proactive leadership, collaboration and integration, and streamlining processes.

3. Team empowerment and decision-making: groups codes that relate to enhancing the autonomy and decision-making capacity of teams, such as autonomy and empowerment.

Examples on the developed themes are described below.

1. Impact of organisational structure on project efficiency: a recurring theme across all responses is the challenge posed by rigid, hierarchical organisational structures. This indicates a common perception that traditional organisational models can hinder project agility and efficiency.

2. Leadership adaptation to organisational constraints: each project manager describes proactive strategies to mitigate the negative impacts of these organisational structures, highlighting a theme of adaptive leadership in the face of structural challenges.

3. Importance of communication and collaboration: many responses emphasise improving communication and collaboration as key strategies for overcoming organisational barriers. This underlines a universal belief in the power of teamwork and integrated approaches in project management.

4. Empowerment for agile decision-making: some responses particularly highlight the shift towards more autonomy and empowered decision-making within the project team as a means to improve responsiveness and agility.

These themes and patterns reflect the critical role of leadership in navigating and adapting to organisational structures and dynamics, emphasizing the importance of communication, collaboration, and empowerment in driving project success within complex organisational environments.

Question 13: Have you adopted a Systems Thinking approach when leading projects? Can you tell me more about this?

14-ML-UK-IF-CN "Absolutely, in the realm of infrastructure construction, Systems Thinking is a fundamental approach that I’ve consistently employed. This methodology is especially crucial in large-scale projects where multiple subsystems interact. For instance, in a recent highway expansion project, adopting a Systems Thinking approach allowed us to understand how different components, such as road design, environmental impact, and local community needs, interconnect and influence each other.

By using Systems Thinking, we were able to anticipate and mitigate potential issues before they escalated. It helped us in identifying optimal points of intervention in the project where small changes could yield significant positive impacts. Moreover, this approach enabled us to balance various aspects like safety, efficiency, and environmental sustainability. By viewing the project as a holistic system rather than isolated parts, we ensured that all decisions were made considering the broader impact on the entire project ecosystem."

10-ML-ME-BL-DE "In the engineering design of buildings, adopting a Systems Thinking approach is not just beneficial; it's essential. Each building is a complex system with various elements like structural integrity, aesthetics, functionality, and environmental sustainability interacting with each other. In a recent project involving the design of a high-rise commercial building, Systems Thinking enabled us to create a design that not only met our client’s needs but also adhered to environmental standards and contributed positively to the urban landscape.

This approach allowed us to see how changes in one aspect of the design could impact others. For example, altering the facade material not only affected the building's appearance but also its energy efficiency and structural requirements. Systems Thinking helped us to understand these interdependencies and make informed decisions that balanced all these factors, resulting in a harmonious and efficient design."

03-ML-UK-RL-CN "Systems Thinking is integral to managing rail projects due to their inherent complexity and the multitude of stakeholders involved. My approach to Systems Thinking involves understanding the rail project as a part of a larger transportation ecosystem. This perspective was particularly useful in a recent project where we were upgrading a rail network. By applying Systems Thinking, we could see how the rail upgrade would not just improve travel times but also affect commuter behaviours, city traffic patterns, and even regional economic development.

This holistic view enabled us to engage more effectively with stakeholders, from local communities to regulatory bodies, ensuring that all concerns were addressed. It also helped in identifying potential risks and opportunities beyond the immediate scope of the rail project. In essence, Systems Thinking allowed us to deliver a project that was well-integrated into the larger system it was part of, ensuring long-term sustainability and efficiency."

The previous responses highlight how systems thinking is applied across different domains in project management, enabling a holistic and interconnected approach to managing complex projects and ensuring their integration into broader systems. The identified codes are described below.

1. Systems thinking utilisation: instances where the project manager describes employing Systems Thinking in their project.

2. Interconnectedness of components: refers to mentions of how various project elements are interrelated.

3. Anticipation and mitigation of issues: applied to segments discussing the proactive identification and addressing of potential problems.

4. Balancing multiple aspects: tags descriptions of managing and harmonizing different project factors such as safety, efficiency, and aesthetics.

5. Holistic project perspective: instances where viewing the project as a whole, rather than in isolated parts, is emphasised.

6. Stakeholder engagement: refers to the approach of involving and considering various stakeholders in the project.

7. Impact beyond immediate scope: applied to mentions of the project's influence on broader aspects like community, environment, or economic development.

The corresponding categories are shown below.

1. Methodology and approach: encompasses the overall strategic approach used in project management, including systems thinking utilisation and holistic project perspective.

2. Project component interaction: includes codes related to how different aspects of a project interact and affect each other, such as interconnectedness of components and balancing multiple aspects.

3. Proactive problem-solving and impact analysis: groups codes that relate to foreseeing challenges and understanding the broader impact of project decisions, including anticipation and mitigation of issues and impact beyond immediate scope.

4. Stakeholder and community considerations: covers aspects of engaging with and considering the needs of various stakeholders, represented by stakeholder engagement.

The common themes that emerged from the identified codes and categories are articulated as follows.

1. Critical role of systems thinking in complex projects: this is a clear pattern across all responses is the reliance on systems thinking to manage complex, multifaceted projects. This underscores a shared understanding of its importance in infrastructure, building design, and rail projects.

2. Interconnectivity and holistic management: there is a consistent emphasis on understanding and managing the interrelated aspects of projects. This indicates a recognition of the need for holistic management to achieve balanced and effective outcomes.

3. Proactive approach to problem-solving: the project managers highlight using Systems Thinking to anticipate potential issues and intervene effectively. This theme suggests that proactive problem-solving is a key benefit of this approach.

4. Systems thinking for stakeholder engagement: most of the responses revealed that systems thinking aids in engaging with stakeholders and understanding the project's wider impact on the community and environment. This theme reflects the approach's utility in ensuring comprehensive and sustainable project outcomes.

The aforesaid themes collectively emphasise the value of systems thinking in managing complex projects, showcasing its role as an inextricable component of versatile leadership in fostering interconnected understanding, proactive problem-solving, comprehensive stakeholder engagement, and awareness of broader impacts. Themes were developed in a similar fashion based on responses from other interview questions. The consolidated results are presented hereafter in tabulated and pictorial formats to convey the essence of the findings in correlation to the research questions and the theoretical framework. Discussion on individual research questions subsequently follows to emphasise the relevance and significance of the developed themes against each research questions.

One of the study's objectives is concerned with the existing gaps in literature in relation to treating leadership as a complex multi-dimensional phenomenon. The link to this objective is solely based on the literature review since it is neither connected to the quantitative data obtained from the survey nor to the qualitative data obtained from the interviews. Although some interview questions could be deemed as being indirectly related to the conjectured gaps, the analysis of the gaps was merely driven by an extensive literature review and the author's own understanding and experience in the subject. The rest of the research questions were attempted and answered based on the results and analysis of the collected qualitative and quantitative data. The key gaps identified in the extant scholarly research on leadership in project management, for engineering and construction projects, can be grouped under three broad categories, namely: (a) dynamic leadership, (b) leadership styles concurrency, (c) multi-dimensionality or the multi-faceted nature of leadership phenomenon, and (d) holistic treatment of leadership by accounting for a, b, and c under one consolidated research. The overarching troubling dilemma is that no study can holistically cover the aforesaid aspects of leadership in a consolidated fashion withing being rendered as infeasible. Therefore, researchers tend to breakdown the problem thereby conceptualizing leadership in a simplistic, perhaps unreliable, model or looking at distinct aspects of leadership partially which ultimately defies the fact that leadership is multi-faceted and shall be treated holistically to formulate a more rigorous understanding of its manifestation. This is analogous to mathematical modelling of natural complex phenomena whereas a physical phenomenon is simplified to enable feasible computations. Although such approach might result in good broader understanding, it still lacks the rigor and comprehensiveness to unravel the intricate complexities and systems thinking of the phenomenon.

Understanding leadership within the context of project management in the engineering and construction sectors reveals its complex, dynamic, and multifaceted nature. This nuanced view challenges the traditional, more static perceptions of leadership, suggesting that a more comprehensive approach is needed to effectively navigate the complexities of modern projects. Despite the lack of comprehensive treatment, some studies have partially addressed some of the identified gaps in project leadership in the engineering industry as described hereafter. However, the extant research is still lagging behind, and innovative approaches to navigating project in the engineering industry leadership are rarely found.

Leadership in the construction and engineering industry must transcend the conventional focus on individual leader traits to encompass a broader range of factors. Shane et al. (2011) advocate for a multidimensional model of project leadership, recognizing that the traditional project management focus on cost, schedule, and quality (the iron triangle) is too limited. They propose that project leadership must consider various interconnected constraints and stakeholder needs, necessitating a more holistic approach to leadership that aligns with the complex nature of modern engineering projects. This is aligned with the results that emphasised on the criticality of stakeholder management and the complexity dimensions related to budget and programme. It is also aligned with the postulate that leadership is a multidimensional phenomenon, and that it would be dangerous to look at it from a narrow and isolated perspective.

Furthermore, the notion of leadership as a static quality is increasingly being challenged by the realities of project management in these sectors. The work of Kasapoğlu (2014) demonstrates that leadership styles in architectural firms vary with the project phase, indicating the need for leaders to adapt their styles to the changing demands of the project lifecycle. This adaptability is further supported by Farler and Haan (2021), who suggest that situational, transformational, and transactional leadership styles are particularly effective, highlighting the importance of flexibility and responsiveness in leadership practices within the engineering, technology, and construction fields. Essentially, such studies have some usefulness due to the characterization of the flexibility and adaptation aspect of leadership. Nevertheless, they still suffer from deficiencies in relation to the understanding of how such adaption mechanism works. In other words, they do not explain how, when, and why a project leader elects to change his or her leadership attitude, behaviour, and styles and what the driving forces behind that are. This latter is quite critical not only for achieving a better understanding of leadership but also to enable the construction of practical models that can be utilised by engineering practitioners and leadership instructors.

The integration of multiple leadership styles is a concept gaining traction in the literature. Thite (2000) suggests that the combination of transformational and technical leadership behaviours can enhance the effectiveness of transactional leadership, especially in information technology projects. This idea of blending leadership styles is supported by Zheng et al. (2019), who found that aligning leadership styles with organisational culture promotes innovative behaviours in project teams, indicating that a diverse approach to leadership can be beneficial in achieving project success and fostering innovation.

In summary, the current discourse on project management leadership in the engineering and construction industry points to a shift away from a one-dimensional, static understanding of leadership. Instead, there is a growing recognition of the need for a dynamic, multi-dimensional, and integrative approach to leadership. This approach acknowledges the complex, ever-changing nature of modern projects and the diverse needs of project teams and stakeholders.

4.6 Research Question I – Dominant Leadership Styles

Research question I seeks answers on the distinctive leadership styles exhibited by engineering project managers during the life cycle of the project. Alternatively said, do project leaders who run large and complex projects exhibit specific leadership styles more than others, and do these leadership styles remain dominant over the life cycle of the project, The research attempted this question by investigating and exploring dynamic leadership aspects, and by diligently navigating the various leadership styles revealed in the QDA. Firstly, the quantitative data consistently showed that the authoritative (directive) leadership style was to some extent dominant for large complex projects, technically complex tasks, and for crisis situations. Although transformational leadership was also abundantly cited in conjunction with complexity and crisis management, the quantitative and qualitative results showed tendency towards authority for the purpose of controlling team behaviour, actions, and hence project performance. This implies a correlation between authoritative leadership styles and project complexity and is apparently mediated by the status of the project. Troubled projects tend to mediate leadership behaviour by forcing more directive behaviour and styles due to stressful circumstances and the need for decisiveness and swift decision making. However, this does not hide the finding that although some project leaders exhibit authoritative styles, they still demonstrate transformational and supportive leadership attitude almost over the entire life cycle of the project, to varying degrees based on the independent variables (i.e. situational factors). The aforesaid result was common between male and female project leadership as revealed in the quantitative and qualitative data, which indicates that there is no gender bias. Likewise, the aforesaid result was independent of geographic region which means that western and eastern project leaders looked at complexity and crisis management in a similar fashion. Moreover, some project leaders indicated that directive styles are commonly assumed during specific periods of the project. For instance, directive styles were common when managing complex stakeholder situations that dictates one person to control the show and manage stakeholders without compromising the relationships with these stakeholders, particularly when stakeholders are governmental agencies. The frequency analysis results shown in Table 4.16 emphasises the dominance and tendency of assuming authoritative leadership styles in an engineering context. For example, the responses to the survey questions on the independent variable leadership styles showed that most project leaders are oriented to assume directive styles when managing complex tasks and in crisis situations. This is evident in the statistical results which shows a high mean above 4.0 for relevant questions. The results of the qualitative analysis give details on the reasons through the developed themes are explained below.

The QDA consistently showed patterns related to authoritative leadership in a complex content particularly in relation to technical and stakeholder network complexity. The developed themes explain the reasons behind such approach by project leaders and are further utilised for the development of the substantive model discussed in Chapter 5. Consequently, there is good agreement between the results obtained from the survey and the analysis of the qualitative data. Evidently, there is a direct interrelation between authoritative leadership and project complexity as depicted in the identified patters and developed themes. Some of the interview quotes that are pivotal to the relationship between authoritative leadership and project complexity are provided in Table 4.17. The quotes are not exhaustive and were strategically selected to portray the boarder theme about the discovered relationship between project complexity and leadership behaviour and attitudes. Codes and keywords are shown in bold font.

Table 4.17

Dominant leadership styles – pivotal interview quotes

Leadership Style	Participant	Pivotal Quotes (used in QDA and Theme Development)
Authoritative (Directive)	01-ML-ME-IF-DE	"in many **complex design** projects, I was **extremely directive** especially when a situation called for quick actions and decision making. We often do not have the privilege of time to brainstorm or engage team members the way we desire to, so giving instructions is a short cut"
	03-ML-UK-RL-CN	"I like to **empower my team and solicit ideas**, team thought process is always useful, however, the project is sometimes u**nder pressure due to aggressive timeline** so we have to be **more directive** and utilise role power to get the job done, even coerce the team to perform if necessary"
	08-ML-NA-BL-CN	"**construction is usually tough** and there is no room for being the kind type. Clients also puts us under pressure, so I have to be the **sergeant type** and just give orders to avoid delays"
Transformational	10-ML-ME-BL-DE	"**empowerment is critical** and it pays off.. My team performs when feel empowered and looked after. I pay attention to their needs, traits, and skills, but I also need to be aware of setbacks and gaps in performance when empowerment goes sideways"
	13-ML-ME-EV-DE	"in the environmental studies field we **look for creativity** all the time, being **transformational in my leadership attitude is what exactly is needed to achieve high performance**. We do experience complex tasks sometimes, but I prefer to lead the team through vision rather than be the command project manager"
	14-ML-UK-IF-CN	"construction sites are like battle fields, but being the vision leader is also beneficial when creativity is sought after, I do **combine authority with transformational styles** for maximum efficiency and productivity on all my construction projects"
Active vs. Passive	17-ML-ME-IF-DE	".. And I **don't leave the team alone till mistakes happen**, because this means abortive works and time delay. It is always important to stay on top of things and check the design on regular basis"
	20-ML-ME-TR-DE	"staying away is kind of psychological, **stay away but not for too lon**g otherwise things might go out of control and errors could be dramatic. It is always good to delegate and let the team decide by themselves on some matters, but stepping in at the right moment is crucial"
	21-ML-ME-TR-DE	"I'm used to micromanagement, but in a good way. **In our business time is of essence**, so I prefer to s**tay in control and watch over the team's design activities** instead of facing surprises down the road"
Supportive	24-ML-EU-IF-DE	"ideally, support is necessary but sometimes we have limitations. **Extra support might be a bad sign of poor competency** so as leader I should be careful about that"
	26-ML-NA-TR-DE	"**no harm in being supportive and directive**, I can easily adapt to that and is has become like a habit, things go with the flow and instructions go out at the right moment while support is still there if needed. These are two sides for the same coin."

4.7 Research Question II – Dynamic Situational Leadership

Research question III seeks to answer whether the project manager assumes multiple leadership styles during the project life cycle and what would be the reasons behind changing the leadership attitude or style. Generally, the quantitative results showed consensus among western and eastern project leaders on the necessity of leadership style adaptation to internal and external contextual and situational factors such as project complexity, team traits and characteristics, internal organisational settings (OFs) and external environmental factors (EEFs). As noted earlier, the aforesaid factors constitute the independent and extraneous variables of the theoretical framework. For example, as shown in Table 4.16, the relative frequency of dynamic leadership and concurrent leadership styles was circa 43%. There was significant agreement among project leaders, notwithstanding gender and geography, on the importance of situational awareness and adaptation to project-specific conditions over the life cycle of the project as shown in Figure 4.15. Relatedly, the statistical mean of the responses was above 4.0, for nearly all questions on situational leadership, for male and female project leaders, and there was significant congruence between the means against each survey question. The majority of participants mentioned that project phases have different burdens and tasks; therefore, each phase could be treated as a sub-project with its own requirements, hence the need to adopt leadership styles that are commensurate of phase requirements. Additionally, the responses to dynamic and situational leadership became stronger when correlated to the variables project complexity and team characteristics as given in Figures 4.13 and 4.14. It was noticeable that complexity and reciprocal influence of the leader-follower dyadic relations have direct link to leadership styles exhibited by project leaders.

The tendency for abrupt changes in leadership attitude and styles was observed for the so-called *extreme circumstances* or *crisis situations*, where both terms are somehow equivalent to the industry ubiquitous term known as *force majeure*.

In respect to QDA, the developed themes were classified as: (a)variable-specific themes, and (b) overarching themes. The variable-specific themes were developed based on the patters and sub-themes formulated against independent variables (*project complexity* and *team characteristics*), dependent variable (*leadership styles*), and the quasi-dependent variable (*leadership process*). The overarching themes encapsulates the entire theoretical framework (all variables), and holistically capture connections and causality relationships in the theoretical construct. Tables 4.18 and 4.19 summarize the variable-specific themes for independent variables. Tables 4.20 summarizes the variable-specific themes for the dependent variables. The themes are given designations following a prescribed naming convention for ease of reference. The designation begins with the letter “T” which refers to the word “Theme”, followed by two-letter abbreviation that refers to the variables (e.g. PC = project complexity, TC = team characteristics, LS = leadership styles, and LP = leadership process), followed by two digits that refers to the serial number of the theme. In summary, there are eight (8) and seven (7) themes developed against project complexity and team characteristics, respectively. And, there are nine (9) themes developed against the dependent variables “leadership styles” and “leadership process”. The dimensions pertaining to leadership style and process were synthesized into groups to consolidate the theoretical underpinnings, and to facilitate the formulation of the substantive models. The overarching themes are holistic and encapsulates all variables as shown in Figure 4.19 which pictorially demonstrates the theme causality construction. This construction has been empirically employed to build the substantive leadership models described in Chapter 5.

Table 4.18

Development themes related to project complexity

Project Complexity Dimension	Theme Designation*	Articulation of the Developed Themes
Technical complexity	T_PC01	Although transformational leadership is preferred in complex situations, technical complexity often attracts directive leadership attitude particularly for high complexity and innovation due to stringent requirements that warrants clear and specific directions to ensure functional disciplines are effectively and efficiently coordinated.
	T_PC02	Innovation invites transformational leadership and team empowerment, but it also occasionally requires directive leadership to manage requirements and expectations. Extra slack granted to team members might have adverse effects and could result in prolongation of activities and programme, and probably conflict among team members
	T_PC03	Multi-disciplinary projects, with cross functional organisational structure, tends to impose directive leadership styles to ensure that subordinates comply with roles and responsibilities, hence avoid duplication of efforts and delays
Stakeholders complexity	T_PC04	Complex stakeholder networks call for authoritative leadership styles especially when governmental agencies and regulators are engaged in the project and has power and influence. Team members shall follow instructions and directions in this respect to avoid conflict with stakeholders which can inadvertently compromise relationships and be detrimental to the project's outcome
	T_PC05	Less restrictive stakeholder environments can be managed using supportive leadership style and team empowerment to take actions and make decisions, but an active leadership attitude shall be maintained to mitigate risks of conflict or mismanagement
	T_PC06	project leaders can be both authoritative and supportive under normal conditions of complexity, except for extreme or crisis situations. For mega projects, there is evidence that directive styles are more dominant due to sensitivity and stringent client requirements and expectations
Budget complexity	T_PC07	Budget constraints which put stress on team members and internal stakeholders such as consultants require authoritative leadership to ensure full control over the budget
Programme complexity	T_PC08	Complex programmes with zero float and well-defined critical path is synonymous with directive leadership to ensure full compliance and to avoid delays. Disruption of activities and uncontrolled delays (e.g. due to force majeure) also call for directive leadership although coaching and team empowerment is sometimes needed to overcome the delays through collective problem-solving and innovative mitigation measures

(*) *T- Theme, PC - Project Complexity. Theme serial number consists of two digits*

Table 4.19

Development themes related to team characteristics

Team Characteristics Dimension	Theme Designation*	Articulation of the Developed Themes
Team Size	T_TC01	Leadership adaptation and exhibition of multiple styles are contingent to larger team sizes in order to accommodate the heterogeneity in team traits and characteristic particularly under certain group dynamics conditions such as the formation of sub-groups. For example, a project leader might be authoritative with one sub-group and supportive with another group.
	T_TC02	Large and complex multi-disciplinary projects commonly involve global teams from different geographies and national cultures. Such large teams interact with the project leader both in-person and virtually via electronic artifacts. Transformational leadership plays a vital role when leading such large multi-cultural teams. Equally important, leadership adaptation to each group's features based on geography and national culture is vital but not critical. It was evident that the same leadership styles are applicable to large in-person and virtual teams alike.
Technical Competency	T_TC03	Higher technical competency among followers (i.e. project leader as line manager) and subordinates (i.e. those from other functional departments) sways leadership attitude to supportive and passive. High technical competency encourages autonomy and empowerment of the team members (i.e. subordinates and followers).
	T_TC04	Nevertheless, the presence of multi-discipline functional teams also warrants directive leadership styles in many situations to ensure control of roles and responsibilities. The extraneous variable internal organisational settings mediate leadership behaviour and styles. For instance, a rigid hierarchical structure with unfavourable setup for project delivery (e.g. functional matrix) attracts more directive styles
	T_TC05	Contrary to T_TC03, high levels of technical competency might equally require more directive leadership styles in some instances due to more resistance by senior team members, especially those who belong to other functional departments
Project Management Maturity (PMM)	T_TC06	A higher level of project management maturity (PMM) is normally advantageous and is associated with less directive and more transformational leadership styles. In technically less intensive tasks (e.g. management oriented), higher PMM leads to passive styles and more empowerment of team members
Collaborative Spirit	T_TC07	There is no strong evidence that a higher level of team collaborative spirit drives the project leader to be less authoritative since leadership styles are greatly influenced by stronger dimensions such as team size and technical competency and is also correlated to other theoretical variables such as project complexity to a larger degree. However, collaboration has a positive impact and arguably attracts supportive and transformational styles under ideal project conditions (i.e. without stress factors such as delay or cost issues)

(*) *T- Theme, TC – Team Characteristics. Theme serial number consists of two digits*

Table 4.20

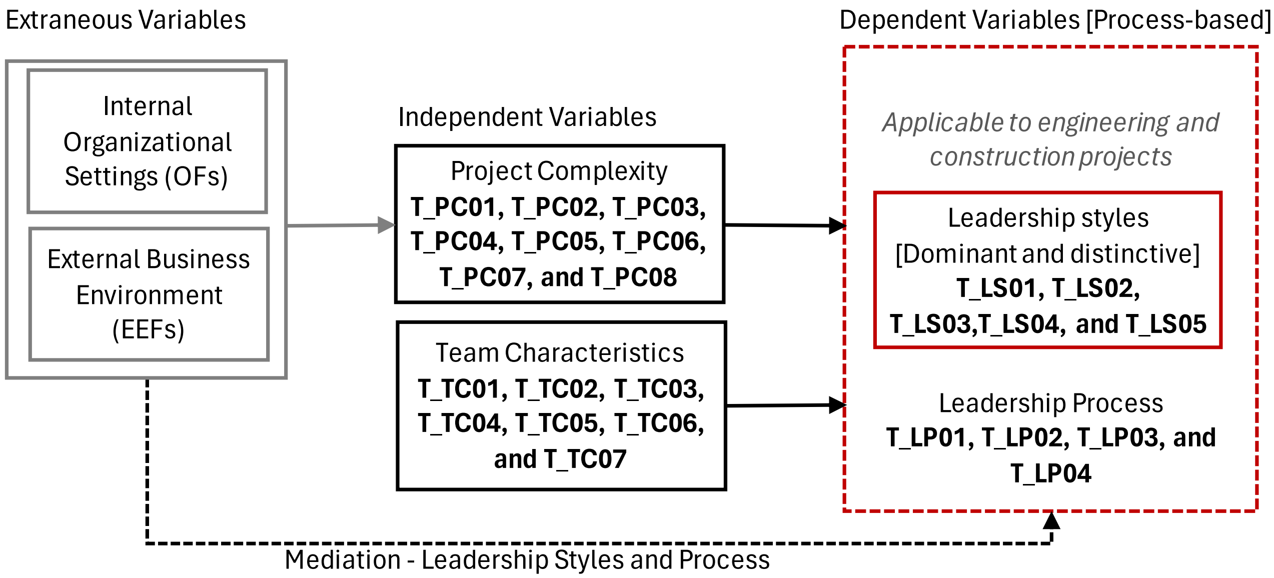
Development themes related to leadership styles and process

Leadership Styles and Process Aspects	Theme Designation*	Articulation of the Developed Themes
Dominant leadership styles distinctive to the engineering design and construction projects	T_LS01	Large, complex, and multi-disciplinary design and construction projects, and technically intensive tasks, attract more authoritarian (directive) leadership behaviour and styles notwithstanding gender or national culture of the leader and team members. The directive style thereto is also not strongly contingent to team setup; being in-person or virtual. The observed exhibition of leadership styles is depicted in the **Four Quadrant Model I** described in Chapter 5.
	T_LS02	Transformational leadership is preferable by engineering project managers, particularly under ideal trouble-free circumstances. Tendency to empower team members is evident among project leaders regardless of gender and national culture. Transactional and passive styles are generally not popular especially for large complex projects. However, transformational leadership behaviour is potentially contingent to stress conditions, project complexity, and team characteristics. This is depicted in the **Four Quadrant Model I** described in Chapter 5.
Leadership styles adaptation and concurrent leadership styles (i.e. simultaneous exhibition of multiple styles)	T_LS03	Adaptation to leadership styles is commonly employed by project leaders, regardless of gender and national culture, to cater for situational factors and heterogeneity of the project's team. Adaptation is highly contingent to complexity, stress conditions, internal organisational settings, and external environmental factors. This is depicted in the **Four Quadrant Model II** described in Chapter 5
	T_LS04	Leadership adaptation and flexibility can be conceptualized as a continuum with convoluted and overlapping leadership behaviours (i.e. leadership spectrum). The occurrence of discrete leadership styles, and transition between such discrete styles, is still plausible under ideal non-turbulent project conditions. This is depicted in the **Leadership Spectrum Model** described in Chapter 5.
	T_LS05	The simultaneous exhibition of multiple leadership styles (i.e. leadership concurrency) is not uncommon in engineering projects with large teams and high levels of complexity. However, it requires considerable experience and people's skills
Dynamic leadership (i.e. temporal and contingent transition between styles)	T_LP01	Dynamic leadership is primarily characterized by transition through a leadership continuum in response to the time-varying situational factors which commonly change over the project's life cycle. The transition mechanism is blurred but can be simplistically defined by the novel concept of *precedent signals* (i.e. signals that indicate an eminent change in leadership attitude and styles)
	T_LP02	Dynamic leadership is two-dimensional since it arguably changes temporally (i.e. horizontally) and vertically within each phase of the project's life cycle. This is depicted in the **VH2D Model** described in Chapter 5.
Leadership as a multi-dimensional dyadic process (i.e. leader-follower dyads)	T_LP03	Leadership phenomenon for the case of engineering and construction project management is evidently highly complex, multi-dimensional (i.e. multi-faceted), and dyadic based on the reciprocal influence of the leader-follower. It is also contingent to several situational and contextual factors.
	T_LP04	The developed themes T_LS01, T_LS02, T_LS03, T_LS04, T_LS05, T_LP01, and T_LP02 can be potentially synthesized into a multi-dimensional dynamic and dyadic leadership model that captures leadership contingency to critical variables.

(*) *T- Theme, LS -Leadership Styles, LP-Leadership Process. Theme serial number consists of two digits*

Figure 4.19

Theoretical framework - superposition of overarching leadership themes



4.8 Research Question III and IV – Formulation of a Substantive Leadership Model

Research question IV seeks to answer the "how" in relation to connecting the results obtained from the innovative treatment of leadership as a dynamic multi-dimensional phenomenon with the ability to formulate a substantive leadership model of practical significance to engineering project managers. The answer to research question IV can be envisaged as the culmination of the findings and conclusions from research questions II and III, and the themes developed from the QDA and triangulated with the quantitative data analysis. As shown in Table 4.20, the synthesis of themes T_PC01 to 08, T_TC01 to 07, T_LS01 to 05, and T_LP01 to 04, supported by corroborations using qualitative data, was employed to develop four substantive models of practical relevance, namely: Four Quadrants I, Four Quadrants II, Leadership Spectrum, and VH2D as described in Chapter 5. As mentioned earlier, the dependent variable, *leadership styles*, seeks to identify the “what” and “why” of leadership behaviour and styles which are dominant and distinct to the engineering and construction industry, whilst the quasi-dependent variable, leadership process, seeks to explore the “how” and “when” of leadership dynamics. Both variables jointly seek to explore the multi-dimensionality of leadership phenomenon. Luo et al. (2021) addressed the dynamic side of leadership in complex mega and giga construction projects by adopting a hybrid simulation which incorporated SEM and system dynamics (SD) to examine the impact of leadership on project performance. Further, a new concept has emerged from the QDA properly dubbed as *Precedent Signals.* This novel concept reasonably explains the onset and mechanism of dynamic leadership style transition and is one of the important implications of the research. Most importantly, a compelling inquiry poses itself in this context as follows: what are the reasons behind formulating four substantive models instead of simply developing one holistic comprehensive model. The response to this peculiar inquiry is furnished at length in Chapter 5 under research implications and recommendations.

As emphasised earlier in this research, project complexity and team characteristics significantly affect project leadership, hence have direct impact on project outcomes. The multitude of interacting variables generate numerous uncertainties thereby forcing project leadership to exhibit non-linearity, and to dynamically evolve over the life cycle of the project. This is practically translated by the need to adapt leadership behaviour and styles by dynamically tailoring leadership styles to cope with situational variables and factors.

4.9 Evaluation of Findings

Leadership theory has evolved significantly, emphasizing the crucial role leaders play in shaping organisational culture, driving performance, and fostering innovation. In the engineering and construction industry, leadership is pivotal due to the sector's complexity, the necessity for collaboration, and the high stakes involved in project success. The analysis furnished in this study explores the dominant leadership styles in engineering and construction industry, underpinned by contemporary scholarly studies. Leadership is conceived as a multifaceted social process-based phenomenon that plays a critical role in the success of projects, especially in industries as complex and dynamic as engineering and construction. Leadership within this context is not just about managing tasks but also involves inspiring, motivating, and guiding teams through challenging projects. Leadership in project management, particularly in the engineering and construction industry, is pivotal for navigating complex projects from conception through completion. This industry's unique challenges, such as tight schedules, budget constraints, and high safety standards, necessitate effective leadership to ensure project success for each project’s phase and over the entire life cycle till handover to the end user.

Undoubtedly, there were numerous challenges with the quantitative and qualitative data collection and analysis. Starting from the design of research and instruments to the execution of data collection, and subsequently selecting the proper methods and tools to undertake the quantitative and qualitative analysis while ensuring validity, reliability, and trustworthiness of data and results. Relatedly, there is a myriad of methods, tools, and techniques to perform data collection and analysis over which experts often argue and could disagree. The methods, tools, and techniques chosen for the current research were carefully considered based on many parameters including timeframe (research programme), feasibility, and practicability. The consideration of longitudinal research, in addition to the current cross sectional one, was thoughtfully deliberated and eventually ruled out based on the nature of the research subject among other constraints and limitations. Generally, data collections and results were satisfactory and coherent, and were examined over a sufficient period of time without haste. The quantitative data collection and statistical analysis, although simplistic, yielded sensible results that were in good agreement with the qualitative data and QDA. As explained earlier, the research is predominantly exploratory in nature, therefore the focus was on the QDA, including thematic analysis as the primary method of analysis. Following the analysis, the attempt to answer the research questions I, II, III, and IV can be claimed to have yielded the desired results; with abundant set of recommendations for future research.

The results of literature review evidently revealed many gaps in the extant scholarly research that can be grouped and summarized under the following broad deficiencies.

(a) Treatment of leadership behaviour and styles as static. This is exemplified in the focus on leader-centric traits without attention paid to other variables that have reciprocal influence on the leader such as team characteristics.

(b) Almost absence of the dyadic relationship embedded in the leader-follower social construct which is analogous to looking at a coin from one side.

(c) The lack of adequate consideration for the multi-faceted nature of leadership phenomenon which is evident in the very simplistic theoretical formulation and models used by most studies. Many of such models ignores important dimensions of leadership and do not account for the process-based nature of leadership. Alternatively said, they arguably treat leadership phenomenon as a black box, and statistically correlate inputs with outputs often to satisfy a quantitative quest rather than to seek in-depth understanding.

(d) The misplaced overutilisation of statistical analysis, ironically aimed at the understanding of an intrinsically complex social phenomenon.

(e) Shortage in practical outcomes of substantive relevance to the engineering and construction industry. There is still a large gap between academic endeavours and the desired benefits for the engineering community.

(f) Fragmented treatment of leadership with noticeable absence of any attempts for holistic conceptualization and theoretical formulation as described hereinafter.

Peng et al. (2022) conducted informatics analysis of literature on leadership in the construction industry and subsequently identified a critical shortage despite the considerable growth in the number of studies over the past decade due to the narrow research subjects which mainly focused on one dimension of leadership or were a mere permutation of analysis on conventional leadership styles (e.g. leader-centric, follower-centric, traits, path-goal, etc). For instance, a large fraction of the extant studies, even among recent ones, is almost exclusive to transformational, transactional, authentic, servant, passive and active, and laissez-faire leadership styles which ideally are not suitable, if considered individually, to investigate and explain situational leadership phenomenon (Umuteme & Adegbite, 2022). Relatedly, Umuteme and Adegbite (2022) elucidate the concept of multi-leadership which calls for concurrent leadership styles to accommodate complex environments. This is analogous to the treatment found in this research which theorizes leadership as dynamic (varying over project's life cycle) and situational as well. Likewise, the many scholars still use very old instruments to conduct quantitative surveys such as the MLQ without expansion, or contextualization, to cater for the evolving thinking about leadership. The novel approaches that extend beyond the aforesaid styles are slim and even silent we it comes to the dynamic and multi-dimensional nature of leadership, needless to mention the very limited studies with a focus on AEC industry.

It is largely cited in literature that success in heavy and construction industries, particularly for multi-disciplinary mega and giga projects, is highly contingent to the project leader and his/her ability to make timely decisive decisions and to lead difficult situations involving commercial claims, programme delays, risks, and complex stakeholders' networks (Danial & Misnan, 2023; Kaur, 2022; Umuteme & Adegbite, 2022; Zwikael at al., 2023). Hassan et al. (2023) assert the role of project leadership in project success and argue that project management literature suffers from a flaw due to the lack of focus on project leadership and its contribution to project success. In this respect, a leader's ability to delegate tasks and communicate clearly with team members and stakeholders in sizable complex projects, such as engineering and technologically demanding projects, in addition to being skilful at persuading people to support the project's vision and changes, largely contributes to positive outcomes and improvement of the performance of troubled projects. Similarly, a leader's ability to deal with conflicts, turbulent and unexpected events, and to maintain leadership under stressful and aggressive circumstances play a vital role in the success of the project (Danial & Misnan, 2023; Latif et al., 2020). Equally important, cultural awareness and ability to cultivate interpersonal skills is essential for innovation and problem-solving in complex projects. The aforementioned leadership attributes and behaviours go beyond the conventional leadership styles, such as transformational and transactional leadership, hence the need to cope with modern changes and to expand existing theoretical treatment of leadership in a more holistic fashion. Relatedly, Danial and Misnan (2023) rightfully refer to the scarcity of scholarly research on leadership in construction projects. This supports the claim made by this research on the noticeable gaps in the extant literature and the lack of rigorous studies that address both task-focused and relationship-focused leadership (Bilal et al., 2020) in the engineering industry, especially in relation to situational leadership over the life cycle of the project.

Holzmann and Mazzini (2020) investigated European project-based companies in the creative industries and highlighted the pivotal role that leadership has in the implementation of successful projects. The authors used a web-based survey followed by semi-structured interviews. Thematic analysis was utilised to analyse qualitative data. Their study showed that the right balance between transformational and transactional leaderships styles produces the most effective results in terms of project performance and creativity. Conversely, the current study showed higher tendency for transformational leadership, and even orientation towards directive leadership styles for complex projects undergoing stress conditions such as programme delays or force majeure. The challenging attribute of creative industries, similar to the case of engineering projects, is complexity which is manifested in the need to combine management and creative thinking processes. The difficulty in leading such projects is magnified when the situation is coupled with complex external environments (e.g. complex stakeholder environment). Consequently, conventional leader-centric or follower-centric, people- or task-oriented, leadership styles seem to be outdated for such complex environments; hence the modern urgency for emerging dynamic styles of leadership that can cope with the ever-increasing business complexity.

A clear theme in most of the reviewed literature is that creative leadership does not favour structure and rules even in hierarchical organisations. As such, it is no surprise that the results from the interviews consistently revealed a tendency for agile project management approaches which cannot be effectively achieved without an emerging dynamic and situational leadership behaviour as evident in the developed themes T_LS01 to 05 and T_LP01 to 04.

Another theme is the avoidance of excessive empowerment which could have unintended consequences or in worst case scenarios might lead to either role overload or unethical behaviour such as non-compliance with the adopted rules or code of conduct (Lin et al., 2023). Similar avoidance of, or technically speaking less tendency for, empowerment of team members was evident for unfavourable organisational structure that does not full power to the project leader such as the case of balanced matrix structures where team members are also managed by functional leaders. In this respect, the developed themes demonstrate departure from empowerment under a few situational conditions including complexity, project stress, adverse organisational structures, among others.

Grant et al. (2001) presented a project leadership model based on the level of involvement by the project manager and the team members. The model predicts four types known as champion (heavy project manager and light team), club director (light project manager and team), conductor (heavy project manager and team), and choreographer (light project manager and team). For a highly involved project manager, dubbed heavy project manager, who is integrally performing along with an active involved team (also called a heavy team), the model depicts the conductor project manager type. Based on structured interviews with project managers (32 case studies on defence projects) at the Air Force Institute of Technology in Ohio, Grant et al. (2001) found that the Conductor model is the prevalent leadership model in a projectized organisation, that has project-matrix structure (PMI, 2017).

Transactional leadership, characterized by a focus on exchanges between leaders and followers, emphasises clear structures, rewards, and penalties based on performance. In engineering and construction, this leadership style supports project management frameworks, ensuring tasks are completed on time and within budget. Studies indicate that transactional leadership positively impacts project success and team dynamics by providing clear direction and expectations (Smith, 2021).

Transformational leadership goes beyond mere transactions, aiming to inspire and motivate employees towards achieving higher levels of performance. This style is particularly relevant in the engineering and construction industry for driving innovation and dealing with complex projects as shown in themes T_LS01 to 05, but with precautions. Research highlights its effectiveness in improving project outcomes and fostering a culture of continuous improvement (Johnson & Lee, 2020). However, the extant research does not address the instances where transformational leadership might fall behind, and whether it is the silver bullet style for all situations.

Servant leadership prioritizes the growth and well-being of team members, creating an environment where employees feel valued and empowered. In the context of engineering and construction, servant leadership can enhance team morale and project sustainability by focusing on long-term benefits and ethical practices. Recent studies suggest that servant leadership is associated with higher levels of team satisfaction and project success (Davies, 2019).

While each leadership style has its merits, their effectiveness in the engineering and construction industry varies based on project type, team composition, and organisational culture. Transactional leadership is highly effective in projects requiring strict adherence to deadlines and budgets. In contrast, transformational leadership is more suited to projects that require innovation and adaptability. Servant leadership, with its focus on team well-being, is crucial for long-term project sustainability and ethical considerations.

Contemporary research underscores the importance of adopting a flexible leadership approach in the engineering and construction industry. For instance, a study by Nguyen (2022) analysed the impact of leadership styles on project success in large construction firms, finding that a combination of transactional and transformational leadership yielded the best outcomes. Other accounts highlighted the successful application of servant leadership in a multinational engineering project, resulting in improved team collaboration and stakeholder satisfaction.

The engineering and construction industry benefits from a nuanced application of leadership styles, tailored to the specific demands of each project. While transactional leadership provides the structure necessary for project management, transformational and servant leadership styles foster innovation, team morale, and sustainability. Leaders who adeptly navigate between these styles, adapting to the context and needs of their teams, are likely to achieve greater project success and organisational growth.

Recent studies often emphasise leader-centric approaches, focusing on traits, styles, or behaviours of individual leaders (Smith, 2023). While these studies provide valuable insights, they sometimes overlook the follower-centric perspective, which considers the influence of team dynamics, feedback mechanisms, and the role of followers in the leadership process. Leader-centric research often focuses on individual traits, such as decisiveness, expertise, and communication skills, which are deemed essential for project leaders in construction and engineering projects. In contrast, follower-centric research emphasises the role of team dynamics, collaboration, and empowerment in achieving project goals. However, both approaches tend to overlook the temporal changes and adaptive requirements of leadership throughout the project lifecycle.

There is a notable gap in the literature regarding the dynamic and time-varying nature of leadership in the engineering and construction industry. Most studies treat leadership as a static construct, neglecting how leadership strategies and effectiveness might evolve over the lifecycle of a project (Brown & Green, 2022). Recognizing leadership as a dynamic construct involves understanding how leaders adapt their strategies to meet changing project demands, stakeholder expectations, and team dynamics. Theories such as Adaptive Leadership and Situational Leadership provide frameworks for exploring these aspects (Adams & Sanders, 2024). Scholarly opinion increasingly acknowledges the need for research that captures the complexity and dynamic nature of leadership in project management within the engineering and construction industry. Recent articles suggest integrating qualitative and longitudinal methods to explore how leadership evolves in response to project challenges and successes (Lee & Nguyen, 2023). The characterization of contemporary research on project leadership in the engineering and construction industry highlights a critical gap in understanding leadership as a dynamic and multi-dimensional construct. Future research should aim to bridge this gap, providing deeper insights into effective leadership practices in this vital sector.

As far as large construction projects are concerned, the complexity and rapidly changing environment of such projects, coupled with a myriad of uncertainties and variables (e.g. stakeholders), necessitates a dynamic project leadership approach to effectively interact with the challenging environment and avoid schedule delays of cost overruns (Luo et al., 2021). Therefore, the dynamic evolution of a complex project over its lifecycle warrants a dynamic, adaptive, and situation-driven leadership style that corresponds to temporal changes of the project’s variables. In this respect, the project leader will have to dynamically adjust the leadership style and behaviour, in response to the project’s variables, to cope with the situational conditions of the project. In other words, the leadership behaviour and systematic approach to interaction with followers will have to follow a non-linear path (Luo et al., 2021) in response to specific situations. For instance, should a difficult situation with stakeholder management emerges, the project leader might elect to be authoritative and give decisive clear directions to the followers to avoid negative consequences. Similarly, issues with safety on projects could impose a situation where swift actions are imperative; therefore, a keen leader will likely adjust to a command-and-control leadership mode and issue formal instructions to the followers, and other concerned parties such as contractors, to take immediate actions. It is evident from the research results that adjustment of leadership behaviour and styles is expectedly a strenuous task for an unexperienced project manager without astute soft skills.

The literature notably lacks a focus on the dynamic, evolving nature of leadership required to manage the complexities of engineering and construction projects effectively. Most studies do not account for how leaders must adapt their strategies in response to project phase transitions, stakeholder demands, and unforeseen challenges. This gap underscores a critical need for research that explores leadership as a fluid and responsive practice. Most importantly, the extant research rarely addressed the combine influence of project and organisational variables. For example, organisations become stressed in times of crisis or volatility in the local, regional, or global markets (Ahmad et al., 2022). This impact has a ripple effect on projects within the organisation which will likely struggle depending on the severity of the circumstances. A famous example is the turbulence and interruption experienced by global projects due to the Covid-19 pandemic. During such crisis events, traditional leadership approaches are not sufficient to navigate complexity (Ahmad et al., 2022) whereby transformational leadership skills, flexibility and adaptability, and decision-making authority become critical ingredients to the successful performance of projects.

Frameworks like Adaptive Leadership, Situational Leadership, and Transformational Leadership offer potential insights into the dynamic aspects of project leadership. Adaptive Leadership, for instance, emphasises the importance of flexibility and responsiveness, which are crucial in the ever-changing project environments of the construction and engineering sector. These theoretical models could serve as bases for developing more nuanced understandings of leadership dynamics in project management. Empirical studies and case analyses provide valuable insights into the practical applications of dynamic leadership theories in the engineering and construction industry. For instance, research on successful project outcomes often highlights the role of adaptive leadership practices in navigating challenges and leveraging opportunities. These real-world examples underscore the importance of dynamic leadership capabilities in achieving project objectives. The critical analysis reveals a significant gap in the literature concerning the dynamic and multi-dimensional nature of leadership in project management, particularly within the engineering and construction industry. Future research should focus on longitudinal studies and empirical research to explore how leadership practices evolve over the lifecycle of projects. Additionally, interdisciplinary approaches that incorporate insights from psychology, business, and engineering could offer more comprehensive perspectives on effective project leadership.

Dynamic leadership refers to the capacity of leaders to adapt their leadership style and strategies based on the evolving circumstances, challenges, and phases of a project lifecycle. This concept is particularly pertinent in industries characterized by high levels of uncertainty, complexity, and rapid change, such as engineering and construction.

Heifetz et al. (2009) concept of adaptive leadership emphasises the importance of leaders being able to respond to changing environments, engage stakeholders in addressing complex challenges, and facilitate adaptive work.

Hersey and Blanchard (1982) situational leadership theory proposes that effective leadership is dependent on the maturity of the team and the complexity of the task. Leaders must adjust their level of directive and supportive behaviours to match the developmental level of their followers. Burns (1978) introduced transformational leadership, which Bass (1985) later expanded, emphasizing the role of leaders in inspiring and motivating followers to achieve beyond expectations through idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration.

In the context of engineering and construction projects, dynamic leadership is crucial for several reasons including navigating complexity, stakeholder engagement, and team adaptability, among many other factors. Construction projects often encounter unforeseen challenges, requiring leaders to pivot strategies quickly (Dvir et al., 2006). Similarly, effective leadership involves engaging a diverse range of stakeholders, from clients to subcontractors, ensuring alignment and commitment to project goals (Walker, 2015). Regarding team adaptability, leaders must foster an environment where team members can adapt to changing requirements, promoting resilience and flexibility (Anantatmula, 2010). However, recent scholarly work continues to emphasise the importance of dynamic leadership in project management. For instance, Müller et al. (2012) argue for the need to understand leadership as a complex interplay between leaders, followers, and the project environment, suggesting that dynamic leadership capabilities are critical for project success.

Dynamic leadership embodies the ability to navigate the complexities and uncertainties inherent in engineering and construction projects. As the industry evolves, the demand for leaders who can effectively manage change, inspire innovation, and guide their teams through the intricacies of project execution continues to grow.

Situational Leadership is a flexible and adaptive leadership model that was developed by Paul Hersey and Kenneth H. Blanchard in the late 1960s. The core principle of this model is that there is no single "best" style of leadership. Instead, effective leadership is contingent upon the situation, including factors such as the task at hand, the maturity level of the followers, and the organisational context. This model emphasises the need for leaders to adapt their leadership style based on the readiness and competence of their team members in relation to specific tasks or goals. The key concepts in situational leadership are outlined hereafter.

1. Leadership Styles: Situational Leadership identifies four main leadership styles:

- Directing: High directive and low supportive behaviour, best for followers who lack competence but are enthusiastic and committed.
- Coaching: High directive and high supportive behaviour, suitable for followers who are beginning to develop competence but still lack commitment.
- Supporting: Low directive and high supportive behaviour, ideal for followers with competence but varying commitment.
- Delegating: Low directive and low supportive behaviour, best for followers who have both high competence and commitment.

2. Follower Readiness: The concept of readiness refers to the extent to which a follower has the ability and willingness to complete a task. Readiness levels are categorized from R1 (low) to R4 (high), indicating progressing levels of follower development and maturity.

3. Adaptive Leadership: The model advocates for leaders to diagnose the readiness of their followers and then adopt the most appropriate leadership style to match the follower's current level of readiness.

In project management, especially within dynamic sectors like engineering and construction, situational leadership proves invaluable. Projects often progress through various phases, each with its distinct challenges and requirements for team involvement. As such, project leaders can benefit from adopting a situational leadership approach to effectively manage team dynamics, motivate team members, and ensure project objectives are met efficiently.

Scholars continue to explore the relevance and application of situational leadership in modern organisational settings. For example, research has highlighted its effectiveness in project-based environments, where the flexibility to shift leadership styles can significantly impact project success and team productivity (Thompson & Glasø, 2015). Moreover, the model's emphasis on leader flexibility and follower development aligns with contemporary views on empowering leadership and adaptive project management practices (Graeff, 1983; Northouse, 2018).

Authoritative leadership, often conflated with autocratic leadership, plays a critical role in environments requiring swift decision-making and firm direction, particularly under the pressure of aggressive project deadlines. Authoritative leadership is particularly valuable in high-pressure situations where the margin for error is minimal, and the need for quick, decisive action is paramount. The singular decision-making authority vested in the leader eliminates the time-consuming process of collective decision-making, enabling more efficient navigation through complexities. This efficiency is crucial in fields such as construction or software development, where deadlines are tight, and delays can have significant financial repercussions. The study underscores the effectiveness of this leadership style in crisis situations, suggesting that the speed and clarity it brings to decision-making can be the difference between success and failure.

This leadership style is characterized by a leader who makes decisions independently with little to no input from team members. While this approach might seem counterintuitive to fostering a collaborative and innovative workplace, it can be highly effective in specific contexts, such as those found in complex situations or industries with tight timelines. In this discussion, we'll explore the applicability and implications of authoritative leadership in such scenarios, supported by scholarly evidence. Authoritative leaders are adept at making quick decisions, a trait that becomes invaluable in complex projects with aggressive timelines. This decisiveness stems from the leader's clear vision and understanding of the project's objectives, allowing for efficient navigation through challenges without the delays that consensus-building processes might incur. For instance, the current research suggests that in high-stakes environments, such as emergency response or military operations, authoritative leadership can expedite decision-making processes, potentially saving time and resources. While authoritative leadership can streamline decision-making, its impact on team dynamics varies. The limited input from team members might lead to decreased satisfaction and engagement, affecting the team's overall morale and productivity in the long term. However, in contexts where the priority is to meet deadlines and manage complex issues swiftly, the trade-off might be deemed acceptable. The research also revealed that in project-based environments within industries like construction and engineering, the clarity and direction provided by authoritative leaders can significantly enhance efficiency and project success rates. The challenge lies in balancing the authoritative leadership style with the needs and well-being of team members. Incorporating elements of transformational leadership, such as inspiring and motivating team members, can mitigate some of the negative aspects of a purely authoritative approach. For example, integrating clear communication about the vision and rationale behind decisions can help team members feel valued and understood, even in a top-down decision-making framework. Authoritative leadership, when applied judiciously, can be a powerful tool in managing complex situations requiring decisive decision-making under tight deadlines. The key to leveraging this leadership style effectively lies in the leader's ability to provide clear direction and make swift decisions while also considering the impact on team dynamics and morale.

Future research should continue to explore the balance between authoritative control and team engagement to optimize outcomes in high-pressure project environments. In contrast, the authoritative approach's efficiency comes with potential limitations, especially regarding team dynamics and innovation. The top-down nature of decision-making may stifle creativity and discourage team members from contributing ideas, potentially overlooking innovative solutions. Furthermore, the lack of input can lead to decreased job satisfaction and a sense of alienation among team members. The research elucidates this trade-off, indicating that while authoritative leadership can streamline project execution, it may inadvertently suppress the team's creative potential and morale. A strategic balance between authoritative decisiveness and participative engagement could mitigate the downsides while capitalizing on the strengths of authoritative leadership. Incorporating participative elements, such as soliciting input on non-critical decisions or explaining the rationale behind directives, can enhance team satisfaction without compromising the efficiency of decision-making. This hybrid approach can foster a sense of inclusion and respect, potentially boosting morale and commitment. The research results evidently show the importance of this balance, suggesting that blending authoritative clarity with transformational leadership traits, such as vision sharing and inspiring motivation, can significantly enhance project outcomes and team cohesion.

In summary, authoritative leadership offers significant advantages in contexts requiring rapid, decisive action, particularly where complexity and tight deadlines prevail. However, its effectiveness is enhanced when tempered with strategies that promote team engagement and morale, underscoring the nuanced application of leadership styles to optimize both project success and team well-being. While authoritative leadership is indispensable in scenarios requiring swift and definitive action, its effectiveness is contingent upon the leader's ability to navigate the delicate balance between assertiveness and team inclusivity. The critical analysis suggests that while the authoritative style excels in efficiency and clarity, its potential to dampen creativity and morale necessitates a nuanced application. Leaders who adeptly integrate authoritative decisiveness with transformational elements can optimize both project success and team well-being, thereby achieving superior outcomes in complex, deadline-driven environments.

In the engineering and construction industry, leadership styles significantly influence project success, team dynamics, and organisational outcomes. Based on contemporary scholarly studies, two dominant leadership styles emerge as particularly effective: transactional and transformational leadership. These styles, alongside situational leadership, have been found to adapt well to the unique challenges of this sector, including project complexity, team diversity, and the need for innovation and sustainability.

Transactional leadership is characterized by a focus on routine, established procedures, and clear, short-term goals. Leaders either reward or discipline team members based on their performance, which can effectively manage construction projects where tasks are clearly defined and time-bound. Liphadzi et al. (2015) identified a positive relationship between transactional leadership and project success in the South African construction industry, underscoring the importance of structured leadership in achieving project objectives.

Transformational leadership goes beyond managing day-to-day operations and focuses on inspiring employees to transcend their own self-interests for the good of the group, thereby fostering an environment of innovation and change. Farler and Haan (2021) highlighted that transformational leadership is among the most effective styles in the engineering, technology, and construction (ETC) industry, promoting sustainability and improving the triple bottom line.

Situational leadership is based on the premise that different situations call for different leadership styles. It is highly adaptable and allows leaders to adjust their approach based on the project phase, team maturity, and individual team members' needs. This flexibility is crucial in the construction industry, where project managers often face rapidly changing environments and diverse team dynamics. In addition to these styles, directive and task-oriented leadership has been identified as prevalent in green building projects, emphasizing the importance of clear roles and goals for project managers in this growing sector of the construction industry. Zhao et al. (2016) found that project managers in Singaporean green building projects favoured a leadership style that balanced task orientation with attention to relationships, indicating a nuanced approach to leadership in specialized construction projects. The construction and engineering industry's success hinges on effective leadership that can navigate the complexities of large-scale projects, manage diverse teams, and drive innovation and sustainability. The evidence suggests that while no single leadership style is universally best, a blend of transactional, transformational, and situational leadership approaches, tailored to specific project requirements and team dynamics, is most effective in achieving project goals and fostering a productive, innovative, and sustainable construction industry.

Empowerment of team members might result in task overload, role stress, or role conflict, especially between competent members (Lin et al., 2023). Therefore, the project leader should carefully assign responsibilities to the team members to avoid the dark side of empowering leadership (Lin et al., 2023).

One of the most intriguing emerging themes is the strong connection between organisational leadership on project management, hence the performance of projects. Apparently, organisational leadership mediates the project leader’s role and enhances the manifestation of leadership behaviour, particularly on large complex projects that are characterized by a large number of interactions, uncertainty, and dynamics. The contribution of organisational leadership as an augmenting factor was also evident in time of crisis. For instance, participants repeatedly mentioned stressed and troubled projects which went into nose dives during the Covid-19 pandemic. Higher levels of organisational leadership maturity promote team cohesion, motivation, and project citizenship, so team members coalesce and perform. Consequently, the chances of the successful recovery of troubled projects become greater. The account by Luo et al. (2023) supports the aforesaid theme and shows that organisational leadership has a strong positive correlation with project management and performance since it mediates the role of the project leader. Nevertheless, the account by Luo et al. (2023) contradicts the results related to the positive impact of systems thinking. In this respect, the feedback by project managers predominantly revealed that systems thinking is pivotal to project success, and is a rare trait of project leaders. Systems thinking enables the project leader to connect the dots, and to navigate the project's dynamic aspects holistically and systematically. In contrast, Luo et al. (2023) claim that systems thinking has no significant relationship with project citizenship and project management in complex engineering projects. Noteworthy, the extant research is plagued with such contradictions and conflicting results, which often are counterintuitive. It could be argued that these contradictions emerge from the gaps in the theoretical formulation of the problem. For instance, leadership is a multi-dimensional complex phenomenon. Therefore, an oversimplified and underdeveloped approach to exploring leadership, especially for technically demanding professions, is likely to result in a misguided and incomplete interpretation. Similarly, over reliance on quantitative analysis, using the commonly used statistical techniques such as partial least square-structural equation modelling (PLS-SEM), can be deemed as a dangerous attempt to discover the intricate features of a complex social phenomenon. Therefore, such persistent issue warrants more concerted efforts by scholars to bridge the serious gaps and to converge the fragmented approaches towards a more rigorous investigation and exploration of leadership.

Conclusions about the population (i.e. project management community) parameters were made using inferential statistics to examine the significance of the quantitative results and to compare with the analysis and results obtained from the qualitative data using interviews. For example, the results of inferential statistics described hereafter cover the survey questions on leadership and systems thinking, dependence of leadership styles on the team's characteristic in-person versus virtual teams, tailoring of leadership styles as a response to dynamic nature of modern projects, and exhibition of multiple leadership styles simultaneously to account for dynamic project conditions and heterogeneity of large global teams. Firstly, sample descriptive statistics of means, medians, standard deviations, and frequencies for each question are used to understand general trends and variability. Subsequently, inferential statistics is employed to check for normality in order to decide on parametric vs non-parametric tests. The tests were conducted to compare responses based on gender and geographic regions using t-tests and ANOVA if assumptions are met, or non-parametric alternatives like Mann-Whitney U or Kruskal-Wallis tests if they are not. This facilitates the assessment of the generalizability of the results to the population of approximately +2,000 project managers based on the sample data. The analysis comprises responses from 126 respondents, focusing on their opinions across the four questions on leader process, namely Q22, Q23, Q24, Q34 (refer to Table 4.10). The sample mean and standard deviation are summarized below against each survey question.

Q22: project leaders use systems thinking, mean is 2.52, and SD is 0.91.

Q23: leadership should be tailored to account for the dynamic nature of projects, mean is 4.56, and SD is 0.65.

Q24: leadership styles are independent of whether the team is virtual or not, mean is 4.62, and SD is 0.64.

Q34: a project leader can exhibit multiple leadership styles simultaneously to properly manage heterogeneous global teams, mean is 4.30, and SD is 0.64.

The analysis of frequency of responses for each question allows the understanding of the distribution of opinions by the respondents. Test for differences in responses based on gender and region can then be examined. This could involve t-tests or ANOVA as corroborated through the text of the normality of the distribution of responses, to choose the appropriate statistical tests, by calculating the confidence intervals to estimate the population means based on the sample. The Shapiro-Wilk test results indicate that the responses for all four questions (Q22, Q23, Q24, and Q34) are not normally distributed, as evidenced by very low p-values in each case. This means that non-parametric tests should be used for inferential statistics, which do not assume a normal distribution of the data. Accordingly, the non-parametric Mann-Whitney U test is used for comparing two independent samples (e.g., gender: male vs female), and the non-parametric Kruskal-Wallis test is used for comparing more than two independent samples (e.g., region: West vs East, as applicable). The Mann-Whitney U test results for gender differences in responses to the survey questions are as follows.

Q22: project leaders use systems thinking. There is a statistically significant difference in responses between males and females ($p = 0.034$). This suggests gender may influence perceptions on the use of systems thinking in project leadership. This is to some extent is not in well agreement with the qualitative results which indicates that the female sample should have probably be increased to further verify this inferential statistical result.

Q23: leadership should be tailored to account for the dynamic nature of projects. There is no significant difference found ($p = 0.302$) which yield a general agreement among the population (i.e. project management community) on the need to tailor leadership styles based on the dynamic nature of the project. The qualitative results largely support this statistical finding as depicted in the developed themes on leadership styles, namely T_LS01 to 05.

Q24: leadership styles are independent of whether the team is virtual or not. Similarly, there is no significant difference ($p = 0.367$). Therefore, a conclusion could be drawn about the sample's population which is also congruent to the qualitative themes T_LS01 to 05.

Q34: a project leader can exhibit multiple leadership styles simultaneously to properly manage heterogeneous global teams. Likewise, there is consensus on this aspect of leadership behaviour as evident in the statistically insignificant difference ($p = 0.159$). The developed themes also corroborate the quantitative results in this respect.

Additionally, the quantitative results based on geographic region (West vs. East) were tested using results the Kruskal-Wallis test to check for variances in the responses as described hereafter.

Q22: project leaders use systems thinking. There is a statistically significant difference in responses between regions ($p = 0.030$). This suggests that opinions on the use of systems thinking by project leaders differ significantly between the West and East regions. The qualitative results revealed a dichotomy regarding this aspect of leadership behaviour. For instance, although there was a consensus that systems thinking is relatively abandoned and not given sufficient attention, some participants from the western geographies mentioned instances were systems thinking was considered in the project management process. However, it was not emphasised later during the life cycle of the project which is probably the reason behind the quantitative data which did not support the assumptions that project leaders utilise systems thinking in a satisfactory manner.

Q23: leadership should be tailored to account for the dynamic nature of projects. There is no significant difference in the responses between western and easter regions ($p = 0.901$). This further corroborates the claim about the generalizability of the results related to dynamic leadership behaviour which is contingent to situational factors investigated in the current research.

Q24: leadership styles are independent of whether the team is virtual or not. There is no significant variance as supported by the calculated p value which equals 0.874. The independency of team location (e.g. in-person vs. remote) was substantiated by the themes on leadership process, namely T_LP01 to 04.

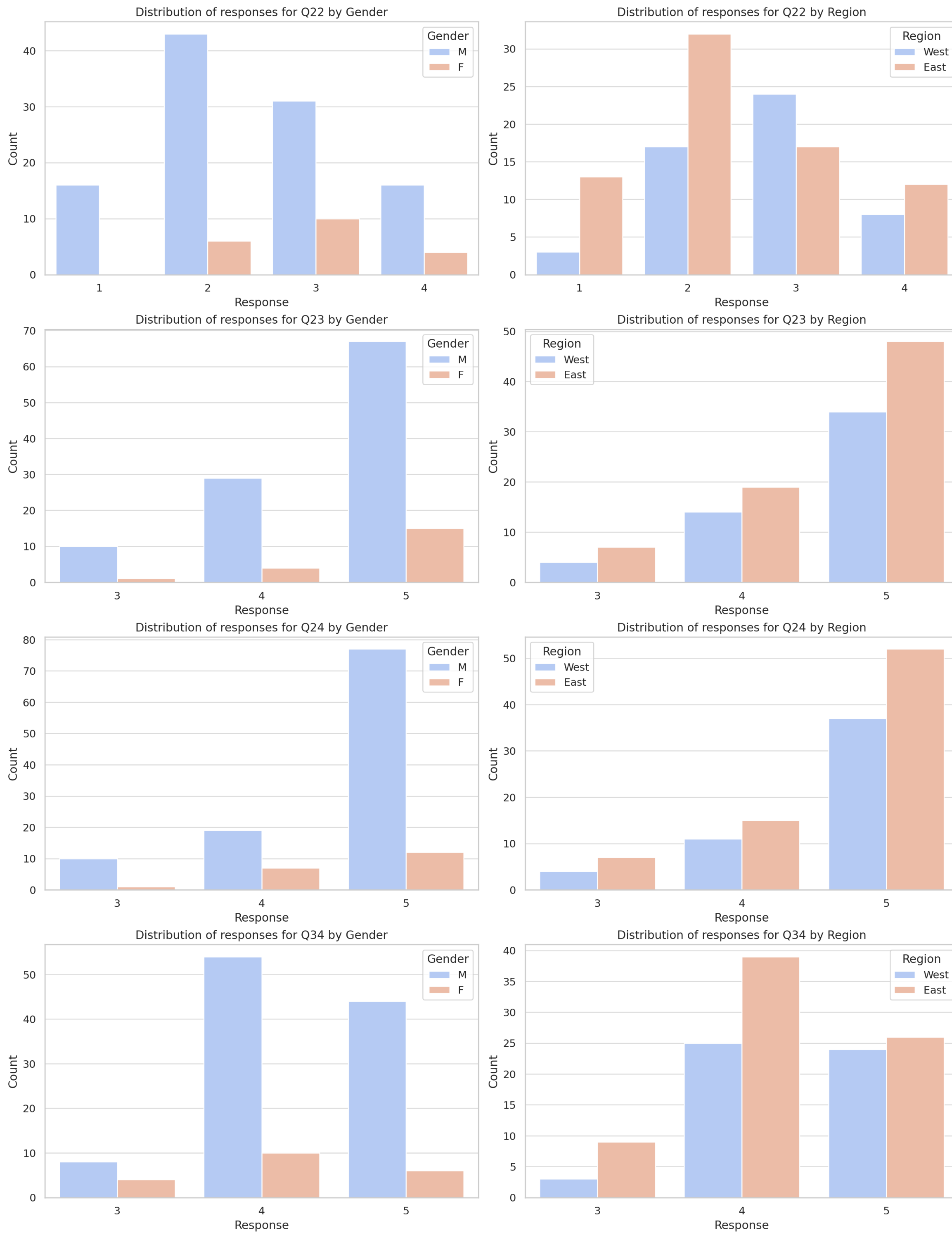
Q34: a project leader can exhibit multiple leadership styles simultaneously to properly manage heterogeneous global teams. The inferential statistical analysis shows no significant variance ($p = 0.142$) which supports the hypothesis about the concurrency of leadership styles, and its plausibility in the context of the AEC industry.

The quantitative data pertaining to Q22, Q23, Q24, and Q34 are graphically illustrated in Figure 4.20 below which shows the distribution of responses based on gender and geography. The left column (gender) shows how responses vary between males and females. Clearly, there is a significant difference in Q22, with varying levels of agreement on the use of systems thinking in project leadership. The right column (geographic region) illustrates how the responses differ between the West and East regions. Evidently, the variation in Q22 aligns with the statistically significant finding that perceptions on systems thinking vary regionally.

In conclusion, the inferential analysis revealed significant differences both by gender and region, indicating varying perceptions on the importance or implementation of systems thinking in project leadership. In contrast, there were no significant differences, by gender or region, on situational and dynamic leadership behaviour aspects suggesting more uniform agreement on these aspects of leadership across the population. The aforesaid inferential analysis provides insights into how different groups perceive leadership aspects in engineering project management, which could be vital for tailoring training and development programs to address specific needs or gaps in understanding as discussed in Chapter 5 under the recommendations for future research.

Figure 4.20

Distribution of survey responses (Q22, Q23, Q24, and Q34) based on gender and geography



The results on situational and dynamic leadership were further substantiated using descriptive and inferential statistical against the survey questions Q2, Q3, Q8, Q17, Q37, and Q40. In this respect, confidence intervals, Mann-Whitney U test, and Kruskal-Wallis test were used to draw on statistical significance, hence draw conclusions on the generalizability of the quantitative results. The fact that the final sample size is 126 whereas the population size is circa 2000 is accounted for the in the analysis. The results of the descriptive statistics are summarized in Table 4.21 below.

Table 4.21

Descriptive statistics of survey questions on situational and dynamic leadership styles

Question	Mean	Median	Mode	Standard Deviation	Minimum	Maximum
Q2	1.65	2	2	0.60	1	3
Q3	3.29	3	4	1.10	1	5
Q8	4.33	4	4	0.55	3	5
Q12	3.82	4	4	0.69	2	5
Q16	3.25	3	3	0.85	1	5
Q17	3.13	3	4	1.00	1	5
Q37	4.27	4	4	0.69	2	5
Q38	3.76	4	4	0.98	2	5
Q39	4.41	4	4	0.57	3	5
Q40	3.56	4	4	1.01	1	5

The statistical mean of 1.65 for Q2 indicates a relatively low agreement that leadership styles should be consistent through the project life cycle which is in perfect agreement with the results obtained from the qualitative data. The results of Q3, Q17, and Q40 show moderate agreement on issues related to changes in leadership style and empowerment during crises. This also coincides with the developed themes which clearly demonstrated that leadership is highly contingent to crisis situations in the engineering and construction industry. This is one of the pivotal results that ubiquitously appear in the substantive models described in Chapter 5.

Similarly, the results of Q8, Q37, Q39 reveal high agreement, particularly on the justification of switching between leadership styles based on situational factors in addition to combining authoritative and supportive styles which according to the participants appeared legitimate and highly probable. Regarding inferential analysis, confidence intervals for the mean was used to infer about the sample's population which approximately include 2000 project managers. The 95% confidence intervals for the mean responses provide an estimate of the population parameters as shown in Table 4.22.

Table 4.22

Inferential statistics – confidence intervals: situational and dynamic leadership styles

Question	Mean	95% Confidence Interval
Q2	1.65	(1.55, 1.76)
Q3	3.29	(3.09, 3.48)
Q8	4.33	(4.24, 4.43)
Q17	3.13	(2.95, 3.30)
Q37	4.27	(4.15, 4.39)
Q40	3.56	(3.38, 3.73)

Responses to Q2 show a low average agreement (Mean = 1.65) on the statement that leadership styles should be consistent throughout the project lifecycle. The confidence interval reinforces that this view is likely shared in the broader population. The confidence intervals pertaining to questions Q3, Q17, Q40 suggest moderate agreement with statements regarding changing leadership styles and empowering team members during crises, indicating that perceptions on leadership flexibility and trust are somewhat mixed among the population. Comparatively, the confidence intervals of questions Q8 and Q37, with high means and narrow confidence intervals, indicate strong agreement with the adaptability of leadership styles based on situational factors and the possibility of a leader assuming multiple styles concurrently. This significantly supports the results of the qualitative data and the underlying postulates used to develop the themes and the substantive leadership models. In conclusion, the quantitate data provided insightful implications suggesting that while there is a strong preference for adaptive and supportive leadership styles, there are reservations about strict consistency in leadership throughout a project's lifecycle. To further corroborate the results and make inferences about the population using non-parametric tests, the Mann-Whitney U and Kruskal-Wallis tests were performed to compare the survey responses between genders and geographic regions. For example, the Mann-Whitney U test is used to compare responses between the two regions (West and East) for the leadership styles questions Q2, Q3, Q8, Q17, Q37, and Q40. This will help to infer whether there are statistically significant differences in leadership perceptions between these two geographic areas. The results of the U statistic are presented in Table 4.23 below.

Table 4.23

Inferential statistics – U statistics: situational and dynamic leadership styles

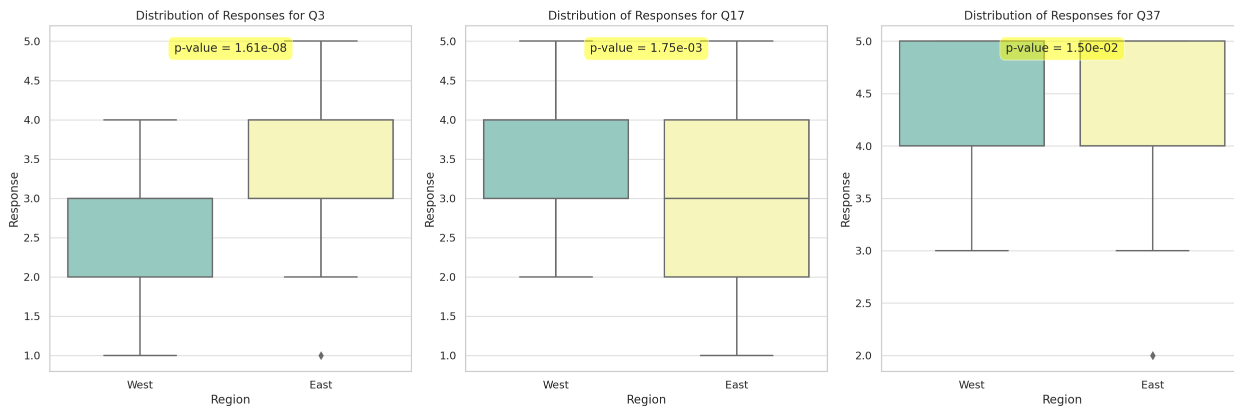
Question	U Statistic	P-value	Significant Difference
Q2	2095.0	0.341	No
Q3	824.5	<0.00001	Yes
Q8	1881.5	0.81	No
Q17	2530.0	0.00175	Yes
Q37	2362.0	0.015	Yes
Q40	2226.0	0.119	No

The results on leadership styles consistency (Q2) and justifiability of switching between leadership styles (Q8) show no significant differences between the responses from different geographic regions.

The results on the perception of leadership style change as lack of confidence (Q3), the empowerment of team members during crisis situations (Q17), and the combination of authoritative and supportive styles (Q37) show significant differences between the regions, suggesting that perceptions on these leadership aspects vary based on geographic location. This is partly disagreeing with the results obtained from the qualitative data which suggests the need for further quantitative analysis in future research. The very low P-value for Q3 indicates a strong regional difference in how changing leadership styles is perceived, potentially reflecting cultural or organisational differences in attitudes towards leadership stability and confidence. In respect to Q17 and Q37, the results suggest differences in how empowerment and leadership style combinations are viewed across regions, which could be useful for tailoring regional leadership development programs. In conclusion, the non-parametric test results provide additional insights, help in corroborating the qualitative data results, and support some of the findings from the descriptive statistics, highlighting areas where regional differences might affect perceptions of leadership in project management. This information could be instrumental in addressing specific regional needs and expectations in leadership training and policy formulation. The results on the distribution of responses for Q3, Q17, Q37 along with annotations for the p-values, to highlight the statistical significance, are depicted in Figure 4.21.

Figure 4.21

U-statistics and p-value for Q3, Q17, and Q37 based on geographic region



The box plot shows the distribution of responses between the two regions (West and East) to visually assess differences in medians and the spread of data. Annotations for p-values are also indicated in Figure 4.21 to reflect the p-values from the Mann-Whitney U test results, emphasizing the statistical significance of the differences. For Q3, there is a clear disparity in responses between the western and eastern regions, as evidenced by the highly significant p-value ($p < 0.00001$). This suggests a strong regional variation in perceptions of whether changes in leadership style might be seen as a lack of confidence. Likewise, the results for Q17 show significant p-value ($p = 0.00175$) which also indicates differences in how empowerment during crises is viewed across regions. Lastly, the p-value against Q37 of 0.015 reflects statistically significant regional differences in the acceptance of a leader assuming authoritative and supportive styles simultaneously which is not in full agreement with the qualitative data. The last result justifiably encourages further quantitative research to ensure that the results obtained from the inferential statistical analysis do not fall under errors Type I and II in order to more prudently confirm whether the quantitative and qualitative data results are in agreement or not. This conclusion is further elaborated in Chapter 5 under the recommendations for future research.

4.10 Summary

The quantitative data obtained from the survey (self-administrated questionnaire, 5-point likert scale) was examined and analysed using descriptive and inferential statistics. The final sample included 126 responses without gaps or errors. The raw data were imported into Microsoft Excel to enable descriptive and non-parametric statistical analysis, and proper presentation of tabulated results. Moreover, the programming language Python was used to perform more complicated inferential statistical analysis. The results from the quantitative data analysis were utilised for validation of the qualitative data analysis. Most of the quantitative results were in good agreement with the findings from the qualitative data, hence supported the themes developed using qualitative data analysis, although some deviations were observed for some survey questions. This encouraged further extended quantitative data collection and analysis under future studies. Qualitative data was laboriously obtained from interviews with project managers from different geographic regions and engineering sectors employed by an international engineering firm. The final sample consisted of 27 project managers from western and eastern global offices. The sample participants were selected purposefully to ensure quality and relevance of the collected data. The qualitative data sample also included male and female participants, but participants were predominantly male project managers. Content and thematic analysis were used to analyse the qualitative data obtained through semi-structured and unstructured interviews. In conclusion, there was acceptable congruence between quantitative and qualitative data analysis, and mixed methods proved to be useful to corroborate some of the results, especially those pertaining to the tendency to exhibit directive leadership styles under extreme project performance circumstances. Demographic variations were introduced to examine their influence on leadership behaviour and styles. Generally, the analysis revealed clear patterns and themes pertaining to leadership behaviour, attitude, and styles and leadership behaviour response to situational variables (e.g. project complexity, team characteristics, etc.) irrespective of gender and geography, including the impact of national culture to some extent which could arguably be attributed to the effect of globalization on the engineering and construction industry.

The results clearly showed the critical role of authoritative and directive leadership styles and their relevance to the AEC industry particularly for large and complex projects, and for projects undergoing distress or crisis situations due to programme delays or budget issues, among many other reasons. Additionally, although transformational leadership was favourable among most project leaders under ideal performance conditions, the results revealed tendency towards authoritative and directive leadership behaviour and styles for large and complex projects undergoing stress conditions such as programme delays, force majeure, scope creep, budget deficit, among others. In this respect, it was evident that leadership styles with more command-and-control nature were somehow the necessary evil to ensure satisfactory performance of projects, and to enable recovery of troubled projects. Stakeholder network complexity, technical complexity, and team technical competency were among the most critical factors (variables) influencing leadership behaviour and styles (Ahmed et al., 2020; Lei et al., 2020). Equally important, internal organisational structure (OFs) and external environmental factors (EEFs) also had mediating effect on leadership styles and process (Umuteme & Adegbite, 2022). The role of transformational leadership in successful project delivery was evident in the qualitative data and in support with recent literature such as accounts by Ahmad et al. (2023), Raziq et al. (2018), and Zheng et al. (2022).

Furthermore, the results emphasised the dynamic and process-based nature of leadership as depicted in the developed themes T_LS01 to 05 and T_LP01 to 04. The results captured in these themes support contemporary research, such as Olugboyega et al. (2023) and Vaagaasar et al. (2020), on the need for the project managers to tailor and adjust their leadership behaviour and styles to workplace, organisational settings, and project situations. The results also provided reasonable proof that leadership can plausibly evolve temporally as a response to situational factors with two-dimensional variation versus time and project phase (i.e. discretely over the project's life cycle). Although directive leadership was predominantly observed as the preferred leadership style during crisis situations, the results also shed light on the pivotal role of building trust to enable empowerment of team members even sometimes during crisis situations (Bhatti et al., 2021). This resulted in the development of useful substantive leadership models that are compact and accessible to practitioners as described in Chapter 5. These models clearly portray the unique nature of the ACE industry which evidently warrants approaches to leadership that perhaps are different from those favoured in other types of industries.

CHAPTER 5: RESEARCH IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

The current research contributes to the growing literature on leadership in project management for the specific case of the AEC industry. The research evidently showed interesting results with significant implications thereby presenting four substantive leadership models of practical relevance to the AEC industry. Firstly, the results generally support scholarly literature on the critical role of directive leadership in complex projects and crisis situations that warrant more control to ensure successful project delivery. In this respect, the research presents two leadership models titled as Four Quadrant I and Four Quadrant II models abbreviated as 4Q-I and 4Q-II, respectively. Relatedly, the results interestingly show that the identified dominant and distinctive leadership styles, captured in models 4Q-I and 4Q-II, are independent of the project leader's gender and national culture to a great extent. Secondly, the research supports the extant literature by addressing the importance of achieving a balance between directive and transformational leadership styles for optimum project outcomes. However, in contrast to literature, the research revealed that such balance becomes more practical for good performing projects under ideal circumstances. Thirdly, the research presents compelling evidence on the implementation of situational leadership and supports recent studies germane to situational leadership theory as discussed hereafter. Unlike contemporary research, the implications not only cover the types of leadership styles, that fit certain situations, but also sheds light on dynamic leadership, namely the mechanism of transitioning between leadership styles and introduces the concept of leadership style concurrency (i.e. multiple styles exhibited simultaneously) and the novel concept of precedent signals, or precedent determinants, which predicts and explains the onset of transitioning between leadership styles. The implications pertaining to dynamic leadership and the novel concept of precedent determinants facilitated the formulation of the Leadership Spectrum and the VH2D models discussed in Section 2. Forth, the research critically refuses the notion of a standalone leader-centric leadership style. It also negates assumptions and theories that claim transformational leadership as being the silver bullet fit-for-all leadership style. In this respect, the research demonstrates that transformational leadership is contingent to other situational and contextual factors such as project complexity, team characteristics, internal organisational structure, and external environmental factors (i.e. the variables incorporated in the theoretical framework). It is shown that these situational factors directly influence leadership behaviour, attitudes, and styles exhibited by the project leaders, or mediate leadership behaviour either towards more directive or balanced transformational-directive styles based on the variability of these situational factors (i.e. the dimensions of each situational factor as discussed in Chapter 4).

The aforesaid implications may seem counterintuitive in some instances, probably due to the overemphasis of the role of authoritative and directive leadership styles. However, the current research strongly supports the applicability of such implications to the AEC industry, especially for large and complex projects (e.g mega and giga projects). For instance, the Gulf Council Countries (GCC), in the Middle East, have been recently witnessing a dramatic growth in the number and complexity of mega and giga projects to meet their globalization objectives and 2030 visions. This was largely evident in countries like Qatar who hosted the World Cup in 2022, and in Saudi Arabia who is planning to host many international events over the next few years including World Cup in 2034. In developing countries, such international events commonly require humongous supporting infrastructure enterprises which commonly come in the form of complex engineering design commissions and large construction projects. Therefore, the research implications could have tremendous benefits to project leaders who run mega and giga projects. As such, more extended future research is recommended to further corroborate and advance such implications as discussed in Section 3.

Project leadership in the AEC industry encompasses a range of leadership behaviours and styles tailored to the sector's complexity and the multidimensional nature of its projects. In this respect, there is evident interplay between directive, transformational, transactional, coaching, and other leadership styles within the AEC industry, underlining their importance in managing the sector's distinctive challenges. Directive leadership, characterized by a command-and-control approach, is prominent in the AEC industry, especially in crisis situations such as project delays or scope expansion. This style involves clear, authoritative instructions and close supervision to ensure tasks are executed precisely and on time. For instance, in the construction of high-risk infrastructure like bridges, where safety and precision are paramount, directive leadership ensures adherence to safety protocols and project schedule. Furthermore, directive leadership styles play a crucial role, particularly in situations demanding swift decision-making and strict adherence to safety and project specifications. Examples that support the effectiveness of directive leadership styles in the AEC industry are described hereafter. A study on Nairobi County's manufacturing SMEs found that directive leadership style significantly influenced organisational performance. This style was positively associated with achieving project objectives efficiently and effectively, illustrating its applicability in environments where clear direction and control are essential for success (Ochieng et al., 2023). Research also indicates that in teams with low functional heterogeneity, directive leadership promoted team reflection, a precursor to successful project outcomes. This suggests that directive leadership can be beneficial in AEC projects where teams are less diverse in their function but require strong guidance to align their efforts towards common goals (Somech, 2006). In the Turkish construction sector, a study revealed that the authoritative (directive) leadership style was more prevalent among managerial personnel compared to other styles. This prevalence underscores the sector's inclination towards a directive approach in managing complex and time-sensitive construction projects (Giritli & Oraz, 2004). In Singapore's green building construction, project managers displaying directive and task-oriented leadership were found to be more effective. This leadership style helped achieve high work performance and productivity, crucial in green building projects where sustainability goals must be met without compromising on traditional project constraints like time, cost, and quality (Zhao et al., 2016) The aforesaid examples illustrate that in the AEC industry, where projects are often large-scale, complex, and subject to strict regulatory standards, directive leadership styles can provide the structure and authority needed to ensure projects are completed on time, within budget, and to the required quality standards.

Equally important, transformational leadership in the AEC industry aims to inspire and motivate employees to exceed expectations by fostering a shared vision and encouraging innovation. This leadership style is crucial for driving change and innovation in construction projects, where creativity can lead to more efficient and sustainable building solutions. Transformational leaders, through their vision and enthusiasm, can foster a culture of continuous improvement and innovation within their teams (Müller & Turner, 2010). Transformational leadership styles have been recognized for their effectiveness in various industries, including the AEC industry. Transformational leadership has been directly linked to enhancing organisational innovation. A study on Taiwanese electronics/telecommunications companies found that transformational leadership positively influenced organisational innovation, mediated by empowerment and an innovation-supporting organisational climate (Jung et al., 2003). In the IT sector, transformational leadership has been found to foster employee creativity, mediated through creative self-efficacy and moderated by knowledge sharing. This suggests that transformational leadership can significantly contribute to fostering an environment that supports innovation and creative problem-solving (Mittal & Dhar, 2015). Furthermore, transformational leadership has been shown to positively relate to organisational commitment, particularly in service SMEs. This relationship is strengthened by a directive leadership style, highlighting the importance of visionary leadership combined with clear, directed goals in enhancing employee dedication and commitment to the organisation (Mesu et al., 2015). An example from a different industry, namely the hospitality industry, shows that transformational leadership has been positively associated with enhancing employee well-being, indicating its beneficial effects beyond traditional corporate settings. This style of leadership enhances the quality of work life, increases organisational commitment, and decreases employee burnout, suggesting its potential applicability in the AEC industry, particularly in hospitality-related projects (Kara et al., 2013). Regarding balanced leadership approaches, mainly those involving directive and transformational leadership styles, it is evident that such approaches in response to project and task complexity, are multifaceted and beneficial to the AEC industry. For example, transformational leadership in the Ethiopian Non-Governmental Organisation sector was found to enhance project success through team-building activities. This suggests that transformational leadership fosters an environment in which team cohesion and collaboration lead to better project outcomes, which can be particularly relevant in complex AEC projects (Aga et al., 2016). In the Taiwanese AEC industry, transformational leadership was positively related to team communication and collaboration, which in turn enhanced project performance. This highlights the importance of leadership styles that promote effective team interaction in managing complex projects within the AEC sector (Yang et al., 2012). Research also found that task complexity was negatively related to transformational leadership behaviour, indicating that as task complexity increases, leaders may act in less transformational ways due to the overwhelming nature of the tasks. This finding is pertinent to the AEC industry as evident in the current research, where leaders often face highly complex tasks and must adapt their leadership styles accordingly (Dóci & Hofmans, 2015). Basically, transformational leadership has been linked to team innovation, especially when leaders integrate knowledge activities and foster a culture of cooperation and learning. This relationship is crucial in AEC projects, which demand innovative solutions and collaborative efforts to tackle complex tasks (Jiang & Chen, 2018). Likewise, the effect of transformational leadership on inter-team collaboration was found to be mediated by internal teamwork quality and moderated by team size. In the AEC industry, where projects often involve multiple teams of varying sizes, understanding the dynamics of leadership style, team size, and collaboration is vital for project success (Cha et al., 2015). The aforesaid examples further underscore the complex interplay between leadership styles, project and task complexity, and team characteristics in the AEC industry, highlighting the need for leaders to adapt their styles according to the project demands and team dynamics.

To a lesser degree, transactional leadership, with its focus on rewards and penalties, is effective in AEC projects for managing specific, well-defined tasks. This style ensures that project milestones are met and that team members are clear about their roles and responsibilities. For example, in project phases requiring strict adherence to deadlines and quality standards, transactional leadership can provide the structure and clarity needed for successful completion (Bycio et al., 1995). On the other hand, coaching leadership is increasingly recognized for its effectiveness in project management within the AEC industry. This style emphasises the development and empowerment of team members, fostering a culture where individuals are encouraged to take initiative and develop their skills. In the context of AEC projects, where diverse expertise and collaboration are crucial, coaching leadership can lead to innovative solutions and enhanced team performance. The practice of coaching leadership in projects has been shown to necessitate a large toolbox of skills, including self-management and a culture of giving, which are essential for project success (Berg & Karlsen, 2016). Effective leadership in AEC projects often involves a combination of the aforementioned styles, adapted to the project's phase and specific challenges. For instance, directive leadership may be essential in the initial stages to establish project parameters and organise resources. As the project progresses, transformational leadership can inspire and motivate the team to innovate and excel, while transactional aspects ensure adherence to project milestones and standards. During later stages, coaching leadership can be pivotal in refining project outcomes and developing team competencies.

The extant scholarly research has supported the effectiveness of combining different leadership styles in project management. For example, transformational leadership has been linked to higher levels of project success and team satisfaction in various industries, including AEC. This leadership style, characterized by intellectual stimulation and individualized consideration, has been shown to foster environments where team members are more committed and engaged, leading to better project outcomes (Howell & Avolio, 1993). In the AEC industry, the complexity of projects necessitates leaders who can adapt their style to meet the evolving needs of the project and the team. Leaders who can effectively integrate directive, transformational, transactional, and coaching styles are better equipped to navigate the complexities of AEC projects, leading to improved project performance and outcomes. Project leadership in the AEC industry is a complex and dynamic endeavour that requires a multifaceted approach. Leaders must be adept at employing a range of leadership styles, including directive, transformational, transactional, and coaching, to effectively manage the unique challenges of AEC projects. The ability to adapt and combine these leadership styles is crucial for achieving project success and integrity in quantitative and qualitative research are of paramount importance and can only be achieved by adopting rigorous protocols, methodology, data are presented separately hereinafter to address their challenges and implications.

Additionally, the internal organisational structure of engineering firms can significantly mediate the implementation and effectiveness of leadership styles. In a study that examined the service structure, the matrix organisation was frequently chosen for projects due to its flexibility and ability to encourage cooperation and communication. This structure fosters a dynamic where conflict is viewed as beneficial, creating an environment where both directive and transformational leadership styles can thrive. The matrix structure allows for negotiation and balance between different leadership styles, promoting initiative and adaptability (Constantinescu & Etegan, 2007; PMI, 2017). Comparatively, studies comparing the effectiveness of Project-Based Organisation (PBO) and matrix organisation for managing complex products and systems found that while PBOs are inherently innovative and flexible, they can be weak in areas where matrix organisations are strong, such as performing routine tasks and coordinating cross-project resources. This suggests that leadership in PBOs may lean more towards transformational styles to foster innovation, whereas matrix organisations may require a balance between transformational and directive leadership to manage both innovation and routine efficiency (Hobday, 2000). A theoretical framework illustrated how the internal social structure of an organisation mediates the relationship between high-performance work systems (HPWS) and organisational performance. In engineering firms, this mediation can be influenced by the organisational structure, where a matrix or projectized environment might impact how leadership styles like transformational or directive are manifested and their effectiveness on team dynamics and project outcomes (Evans & Davis, 2005). Analysis of organisational structuring has shown that the optimal design trades off the benefits and costs of different configurations, such as matrix or projectized structures. The choice between these structures can influence the leadership style, where projectized structures may favour more transformational leadership to navigate the dynamic project demands, while matrix structures might necessitate a mix of directive and transformational leadership to handle both the project and functional demands effectively (Harris & Raviv, 2000).

In the United States, the study by Gattiker and Carter (2010) emphasised that project champions' ability to gain commitment for environmental projects within their organisations is influenced by external factors such as customer pressure and government regulation. This suggests that project managers in engineering firms must adapt their leadership behaviour to align with these external pressures to ensure project success. Thamhain (2012) found that the business environment and leadership style impact team performance in technology-based projects. Canadian project managers in complex, multinational project environments need to adopt leadership styles that cater to both human and organisational needs, influenced by the global and local business environment. Hussain et al. (2021) explored how external environmental factors like political, economic, and social elements in large-scale construction projects in the Middle East moderate the relationship between project managers' personality traits and project success. This indicates that the external business environment necessitates a specific leadership behaviour that aligns with the prevailing conditions. In Malaysia, Wong et al. (2014) investigated the impact of external business environment elements like dynamism and hostility on business process management and organisational performance. The findings highlight that project managers must navigate these external conditions, adjusting their leadership strategies to enhance performance and manage processes efficiently. These studies illustrate how the external business environment, encompassing stakeholders, economic conditions, environmental regulations, and political forces, requires project managers in engineering firms to exhibit adaptable and responsive leadership behaviours. The geographic diversity of these examples underlines the universal importance of understanding and reacting to external influences in project management and leadership.

Clearly, the literature supports the role of the external environmental factors in mediating and influencing the leadership styles of project managers, particularly transformational and directive styles. The way these external factors impact leadership behaviour can vary depending on the specific context, including the industry, region, and nature of the project. For instance, economic stresses, such as market volatility, recession, or booming economic periods, can significantly influence the adoption of leadership styles. In economically unstable times, project managers might adopt a more directive leadership style to ensure tight control over project costs and deadlines. Conversely, during periods of economic stability and growth, transformational leadership can thrive, as leaders seek to inspire and innovate, driving their teams towards new opportunities and improvements. Further, the legal and regulatory environment can also impact leadership styles. In industries facing stringent regulations, project managers may need to employ a directive approach to ensure compliance with legal standards and avoid penalties. However, transformational leadership is essential to navigate through these changes innovatively, finding new ways to achieve compliance while maintaining performance and competitive advantage. Similarly, rapid technological changes can necessitate a transformational leadership approach, as leaders need to inspire and guide their teams through innovation and adaptation to new technologies. However, the integration of new technologies into existing systems and processes may require a more directive approach to manage the transition effectively and ensure that all team members are aligned with the new technological direction. The broader socio-political environment can also influence leadership styles. In regions experiencing political instability or social unrest, directive leadership may be necessary to maintain control and navigate through uncertainty. However, in more stable socio-political environments, transformational leadership can be more effective, focusing on long-term goals, team development, and organisational growth.

Equally important, the demands and expectations of clients, partners, and other stakeholders can shape leadership behaviour. Directive leadership may be prevalent in projects with strict client requirements, tight deadlines, and high-quality standards, necessitating a focus on efficiency and control. On the other hand, transformational leadership is important for engaging stakeholders, understanding their expectations, and aligning project goals with their vision and needs.

In highly competitive industries, the pressure to outperform rivals can influence the choice of leadership style. Directive leadership may be essential in executing projects swiftly and efficiently to gain a competitive edge. However, transformational leadership can foster a culture of continuous improvement and innovation, helping the organisation stay ahead in the long run by adapting to market changes and emerging trends. Directive leadership is characterized by clear, centralized command and control, often seen as most effective in structured environments requiring quick decisions and strict adherence to protocols. The influence of external environmental factors significantly impacts the application and effectiveness of directive leadership as described hereafter for some of the external environmental dimensions. Directive leadership is significantly influenced by external environmental factors like organisational complexity, regulatory requirements, and the need for rapid response in crises. Theoretical models like Path-Goal Theory, Situational Leadership Theory, and the Vroom-Yetton-Jago Decision-making Model provide frameworks for understanding when directive leadership is most effective, emphasizing the importance of aligning leadership style with situational demands. Directive leadership is particularly effective in environments characterized by uncertainty and complexity. Leaders adopt a directive style to provide clear direction and ensure consistency in operations, particularly in sectors like manufacturing or during economic downturns, where quick, decisive action is necessary (House, 1971). In industries with stringent regulations, such as healthcare or finance, directive leadership ensures compliance and minimizes risk. Leaders in these fields often employ directive styles to navigate the complex regulatory landscape and maintain operational integrity (Hersey & Blanchard, 1969). During crises, such as natural disasters or urgent business setbacks, directive leadership becomes crucial. The immediate, clear directives and controlled decision-making process help in managing the situation effectively and mitigating risks (Vroom & Yetton, 1973).

Some of the renowned standalone theoretical models germane to directive leadership are path-goal (House, 1971), situational leadership (Hersey & Blanchard, 1969), and Vroom-Yetton-Jago Decision-making models (Vroom & Yetton, 1973). Path-Goal theory, proposed by House (1971), suggests that the leader's style should align with the followers' needs and the task requirements. Directive leadership is recommended when tasks are ambiguous or challenging, providing clear guidance to achieve goals (House, 1971). Situational Leadership Theory by Hersey and Blanchard (1969) posits that leadership style should be contingent upon the maturity level of the followers. Directive leadership is seen as effective for less mature followers who require clear guidance and direction. Vroom-Yetton-Jago Decision-making model emphasises the situation's role in determining the appropriate leadership style. Directive leadership is ideal in scenarios where quick and decisive action is needed, and the leader has the necessary information and authority to solve the problem (Vroom & Yetton, 1973).

In the construction industry, where projects are complex and timelines are critical, directive leadership ensures that activities are completed on schedule and according to specifications. In military operations, where quick, decisive actions are essential for success and survival, directive leadership is predominant, emphasizing clear commands and strict adherence to protocols.

5.1 Recommendations for Application

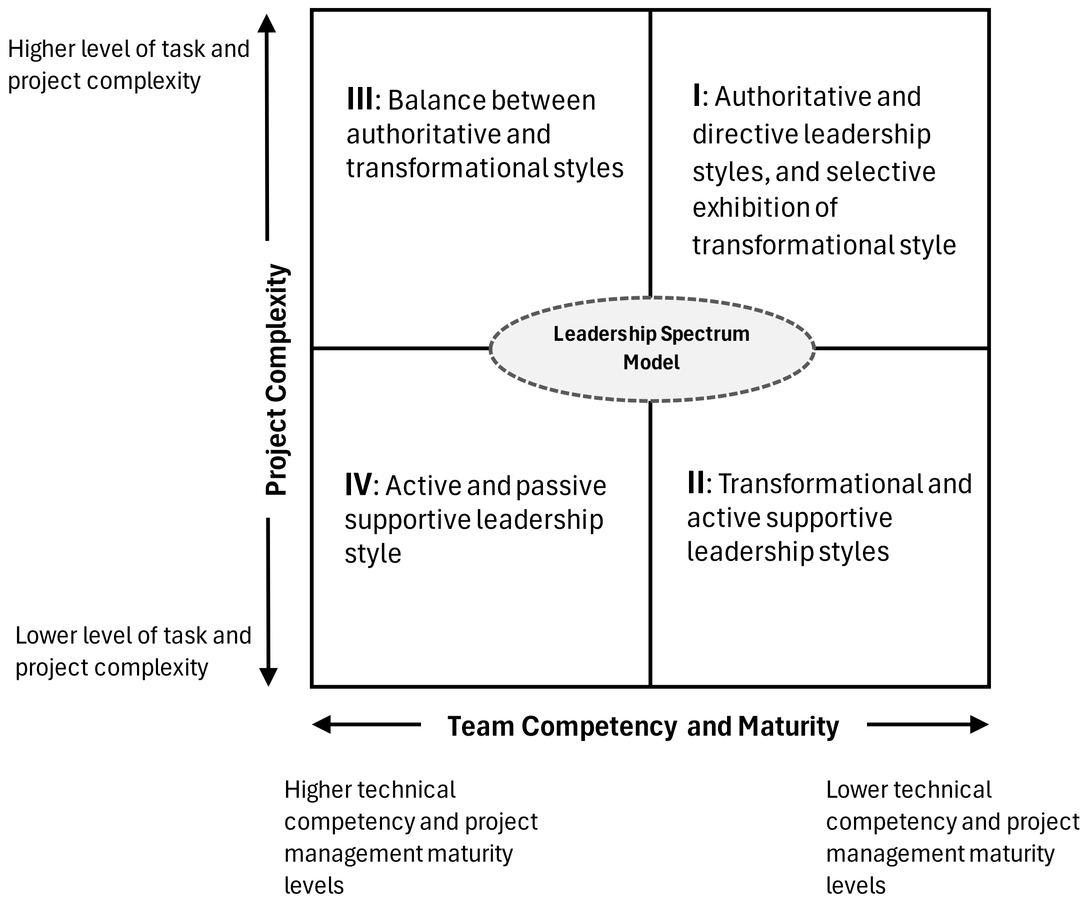
The results of the quantitative and qualitative analysis were synthesized and consolidated to formulate four substantive models of practical relevant to the AEC industry; namely: Four Quadrant Model I (4Q-I), Four Quadrant Model II (4Q-II), Leadership Spectrum, and the VH2D model. These models exemplify the epitome of the findings on dominant leadership styles and situational leadership behaviour applicable to the AEC industry. Most importantly, the substantive models were deliberately simplified, in a reasonable manner, to make them accessible to engineering practitioners who are not well versed with sophisticated model of highly academic nature. Relatedly, there is a usually a lack of this sort of simplification attempts in the academia which often undesirably leads to less attractiveness and practical implementation by the professional community. As such, the simplification of models should be advocated, as much as applicable, to enable practical implementation by the engineering community provided that oversimplification is avoided. As explained hereafter, the four substantive models depict the contingency of leadership behaviour to the investigated situational variables including project complexity, team characteristics, organisational structure, and external environmental factors as shown under the 4Q-I and 4Q-II models. A seminal aspect of leadership behaviour, manifested in the models, is the conceptualization of leadership phenomenon (i.e. behaviour and styles) as multi-dimensional and time-varying which rigorously led to the treatment of leadership as a continuum rather than discrete occurrences of styles as shown in the Leadership Spectrum model. Another novel feature is that the models also capture the contingency and variability of leadership behaviour and styles over the project's life cycle as shown in the VH2D model. Although the four models are developed and presented distinctively, they are essentially inextricable and interlinked. Further exploration of such intrinsic links invites future research.

5.1.1 The Four Quadrant I Model (4Q-I)

The Four Quadrant I model, abbreviated 4Q-I, captures the direct influence of the situational variables (factors) of project complexity and team characteristics on leadership behaviour and styles. The research results largely support such contingency and help in explaining the relationship between situational variables and the prevailing leadership styles. The 4Q-I model is shown in Figure 5.1. The model consists of four quadrants that are utilised to categorize the evidence-based leadership behaviour and styles in response to the variability of the situational factors along the horizontal axis (team competency and maturity) and the vertical axis (project complexity).

Figure 5.1

The 4Q-I model of leadership styles applicable to the AEC industry



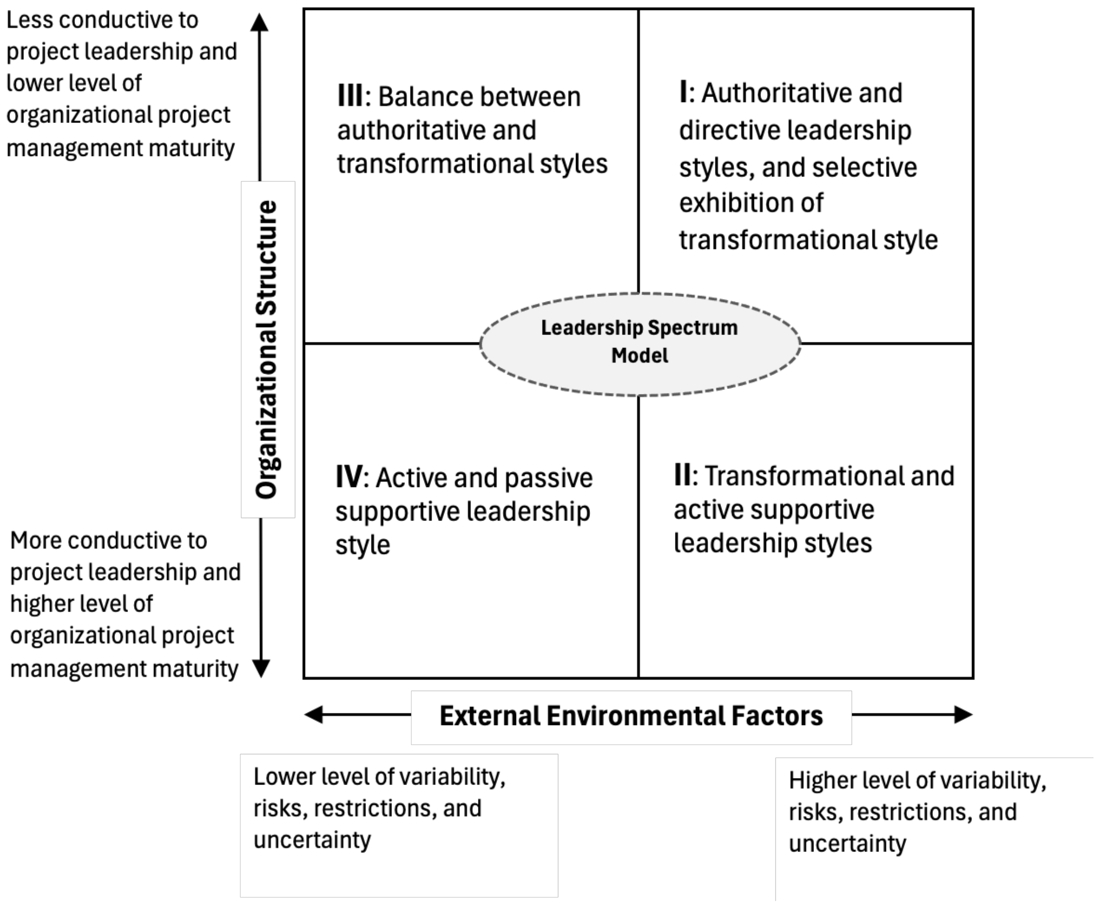
Essentially, the four quadrants succinctly present the dominant leadership styles for each level of project complexity and team competency and maturity. Although other situational leadership styles might manifest themselves due to the complexity of leadership as a social phenomenon, the purpose of the model is to capture and present the key dominant leadership styles prudently. The first quadrant (I) presents the leadership styles which are preferable when a project leader is confronted with adverse or unfavourable conditions such as project complexity, whether technical or stakeholder network complexities among others, and a low level of technical competency and project management maturity among team members and subordinates. In such situations, it is advisable to assume a directive leadership style and selectively exhibit transformational leadership to ensure full control over the team and project performance. The second quadrant (II) is characterized by less project complexity but still low level of technical competency and project management maturity on the team and subordinates' side. The lower project complexity levels result in more relaxation of authoritative styles which grants the leader an opportunity to assume transformational-oriented styles, thus become more attentive to the individual needs of the team members, thereby managing their efforts and outcomes more effectively and empathetically. In this case, the project leader could opt for being supportive. However, due to the low technical competency and project management maturity among team members, the leader is likely to remain active while supporting the team. In other words, the leader shall proactively lead the team and anticipate underperformance, and potential mistakes, before they happen in order to mitigate risks and maintain good performance. The third quadrant (III) features unfavourable conditions and challenges attributed to high project complexity; however, it has advantageous conditions in relation to team characteristics and skills. As a response to this combination of situational conditions, the project leader that the opportunity to balance between directive and transformational styles due to the high competency of the team members. For instance, instead of spending more time on directing the team and giving instructions on specific complex tasks, the leader can focus on vision and goal alignment, and can opt for further empowerment of the capable team members. This offers the leader more time to be attentive to individual needs and to realign the team's subgroups to maximize performance and meet project's objectives. The fourth quadrant (IV) which is characterized by low project complexity and high team competency is deemed as the "comfort zone" for project managers. Such rare stress-free conditions, especially for the case of complex mega and giga projects, give the leader ample time to focus on the strategic matters of the project while actively or passively supporting the capable team members over the life cycle of the project. The passive supportive style is somehow equivalent to the laissez-faire leadership style which is characterized by minimal supervision and a high degree of autonomy and empowerment granted to team members. This style is often discussed in contrast to more directive or participative leadership styles. Although the laissez-faire style can sometimes lead to negative outcomes, such as increased workplace stressors and bullying due to lack of clear guidance and support (Skogstad et al., 2007), it is argued that under certain conditions, with favourable situational circumstances, the laissez-faire leadership style might lead to positive outcomes by allowing employees more freedom to innovate and make decisions independently (Yang, 2015). Under extremely unfavourable conditions, the laissez-faire style is likely to results in adverse impacts, if compared to transformational or transactional leadership, and lower satisfaction and performance levels among team members and subordinates (Hinkin & Schriesheim, 2008). The 4Q-I model features the Leadership Spectrum model at the centre which is shown as shared by all quadrants. This fundamental conceptualization and vital contribution of the Leadership Spectrum model is discussed in section 2.3.

5.1.2 The Four Quadrant II Model (4Q-II)

Th The Four Quadrant II model, abbreviated 4Q-II, captures the direct influence of the situational variables (factors) of organisational structure and external environmental factors on leadership behaviour and styles. The research results largely support such contingency and help in explaining the relationship between situational variables and the prevailing leadership styles. The 4Q-II model is shown in Figure 5.2. The model consists of four quadrants that are utilised to categorize the evidence-based leadership behaviour and styles in response to the variability of the situational factors along the horizontal axis (external environmental factors) and the vertical axis (organisational structure). The model is shown in Figure 5.2.

Figure 5.2

The 4Q-II model of leadership styles applicable to the AEC industry



The first quadrant (I) is characterized by adverse and unfavourable conditions including higher variability, risks, restrictions and uncertainty in the external environmental factors, a low level of organisational project management maturity, and an internal organisational structure that is less conductive to successful project delivery. The latter condition is commonly witness in organisations that are less projectized and has multiple technical functions collaborating concurrently to deliver the project without formalized power and autonomy at the project manager's hierarchal level. This adverse situation gives less control over subordinates who are managed, and reporting to, functional managers such as the case of the weak matrix structure (PMI, 2017). Under similar undesired conditions, more authoritative and directive styles are advisable in order to manage and control the team roles, responsibilities, and performance. It is important to note the directive style mentioned in this context stems from the leader's formalized project management role and not from the organisational-wide authority. For instance, the project leader could be a functional manager who is horizontally equivalent to other peers from different functional departments. Therefore, the project leader's authority in this case is attributed to the formal appointment as a project manager; however, such authority might often conflict with the roles and responsibilities of other peers in the organisation under less conductive organisational structures and settings. Further, the selective exhibition of transformational leadership could be helpful in exerting more control over the team through individualized attention and goal alignment, especially in multi-disciplinary projects run by various functional departments. Accordingly, the wisdom and experience of the project leader would assist in determining the optimum balance between directive and transformational leadership styles. The second quadrant (II) features higher degree of complexity in the external environmental factors but a favourable and leadership-conductive organisational structure. The advantage of the leadership conductivity is that it would enable the project leader to exhibit more transformational and active supportive styles despite the presence of high variability and risks in the external environmental factors. In this respect, the organisational structure offers the project leader autonomy and power over the team members which grants the leader more room for focusing on the strategic project issues. For troubles projects undergoing distressful conditions, such as delays or dissatisfied stakeholders, the presence of a leadership-conductive structure is essential for project recovery as largely evident in the results and themes associated with the qualitative data analysis. Additionally, advantageous organisational structures, such as strong or balanced project matrix (PMI, 2017), offers the project leader more opportunity to be supportive but still actively engaged with the team members due to the presence of adverse external business environments. Most importantly, it could be argued that the freedom to exhibit more transformational and active supportive styles, under adverse external business environments, also requires team members with high technical competency and maturity. This interestingly leads to the proposition that the leadership styles captured in the 4Q-II model are also contingent to the situational variable(s) attributed to 4Q-I, and also dependent on the project phase since the project phases themselves are characterized by different complexities and contingency to external business environments. This plausible and intricate identification of the additional layers of complexity to the leadership phenomenon is what gives the Leadership Spectrum Model its vital importance and critical complementary role on a broader level of understanding. The third quadrant (III) allows the leader to exhibit more transformational leadership, due to lower complexity in the external environmental factors, but still calls for directive leadership to control the team roles and project outcomes due to the lower levels of leadership conductivity in the organisational structure. As such, the project leader could opt for achieving a balance approach between directive and transformational leadership by focusing on team empowerment and goal alignment while maintaining an adequate level of authority and directiveness to mitigate risks. The fourth quadrant (IV) is characterized by favourable conditions on both the organisational structure and external environmental factors sides, which exemplifies a hustle-free comfort zone for project leaders, and as described by interview participants an “ideal dream condition” that is rarely encountered in multi-disciplinary projects. Evidently, similar situational conditions give the project leader ample time to focus on the project’s strategic matters and to sufficiently align the team members on the vision and goals due to the lower variability and risks in the external business environment and the high level of formalized autonomy. As evident in the research results, external environmental factors (EEFs) play a significant role in influencing project leadership behaviour and styles, especially within different organisational structures, and can mediate leadership styles in scenarios with varying degrees of formalized power and autonomy. In strong matrix structures where project managers have significant formalized power and autonomy, EEFs such as political, economic, and social factors can still moderate the influence of project managers' personalities on project success. These EEFs act as moderators between leadership traits like extraversion and openness and project outcomes, thereby shaping how project leadership is executed within the organisation (Hussain et al., 2021). In environments with less favourable organisational structures, where leaders face barriers to autonomy and power, the external environment becomes even more critical. In this case, the adaptation to and management of EEFs are vital for leadership effectiveness. Leaders must navigate through a complex interplay of organisational culture and external pressures, which significantly impacts project team performance and leadership style effectiveness. These leaders need to employ adaptive leadership styles that align with both internal constraints and external environmental pressures to optimize project outcomes (Ahmed et al., 2023).

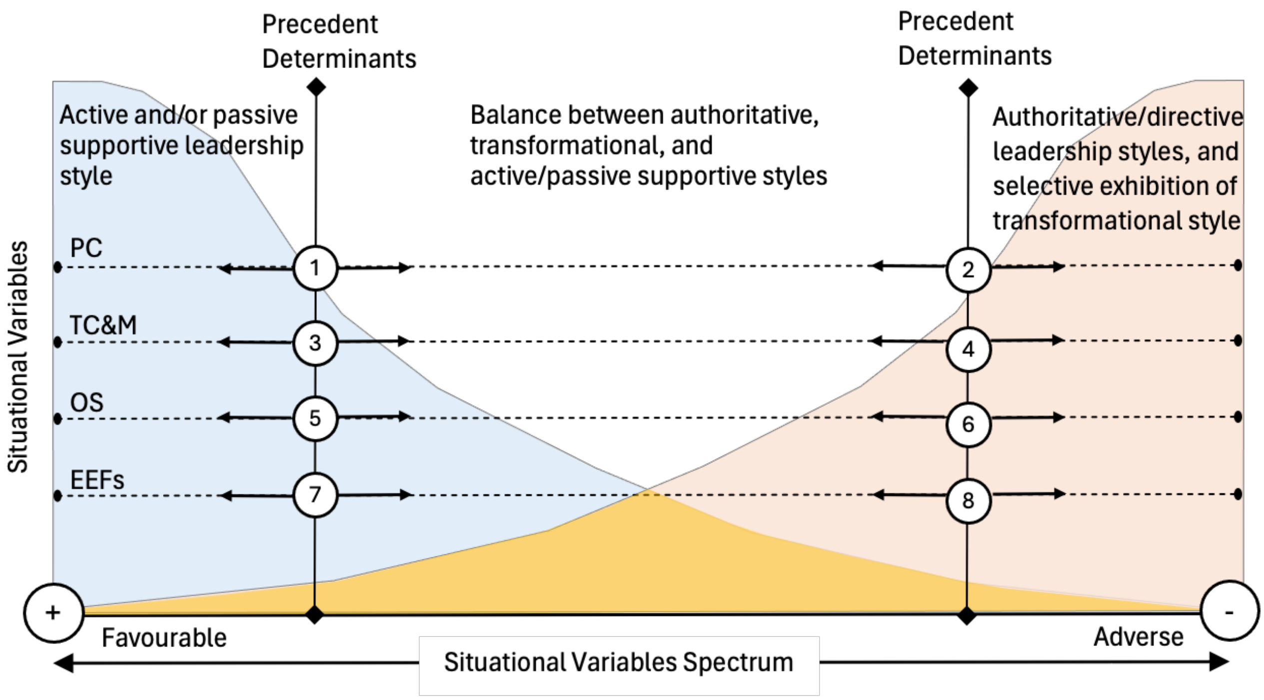
Undoubtedly, the project leader would have more odds of achieving the desired outcomes and meeting the project's objectives if the team members have higher levels of technical competency and project management maturity, and if project complexity does not pose a challenge (e.g. for smaller size single-disciplined projects). As discussed earlier, this emphasises the multidimensionality of leadership phenomenon, and highlights the importance of more holistic and time-dependent models such as the Leadership Spectrum Model. As previously explained, the noticeable variability in the project delivery settings, and organisational structure thereto, among the global offices of the case study engineering firm, had enabled the investigation of the organisational structure as an independent variable. For smaller engineering firms, with or without global offices, the likelihood of not being able to investigate the influence of organisational structure would have been higher possibly due to the standardized and rigid implementation of project management by such smaller firms (i.e. although this could not always be the case).

5.1.3 The Leadership Spectrum Model

The novelty of the Leadership Spectrum model lies in its ability to capture all situational variables presented under the 4Q-I and 4Q-II models, and to furnish the so-called Precedent Determinants which essentially define the onset of transition between leadership styles over a continuum of variability in the situational factors as illustrated in Figure 5.3. Although the Leadership Spectrum model might look complicated from the first sight, it is fundamentally accessible to the non-academic project leadership community as explained hereinafter. The model is constructed from four elements. The vertical axis shows the four situational variables (i.e. independent and extraneous) that were investigated in the quantitative and qualitative data analysis.

Figure 5.3

The Leadership Spectrum model applicable to the AEC industry



PC: Project Complexity, TC&M: Team Competency and Maturity, OS: Organizational Structure, EEFs: External Environmental Factors

The horizontal axis captures the variance in the situational variables along a continuous spectrum, hence the name given to this model. The characterization of the situational variables moves from favourable at the far left of the spectrum (designated by the positive sign, and blue ascending curve towards the left) to adverse at the extreme right of the spectrum (designated by the negative sign, and red ascending curve towards the right). The wedge-shaped intersection between the two-coloured curves (i.e. red and blue) at the middle of the spectrum represents more comfortable and ideal situational conditions; characterized by the amber colour. As we move to towards the right along the spectrum, project's situational conditions become more adverse, and pose more barriers and risks. Therefore, they contingently require more directive leadership styles and the selective exhibition of transformation leadership based on the existing combination of situational variables and the degree of variability among them. On the other hand, traversing towards the left is accompanied by more favourable situational conditions which call for more balance between transformational leadership and active/passive supportive leadership. The two vertical lines, nearly in the middle of the red and blue curves, depict the novel concept of the Precedent Determinants. These Precedent Determinants critically come in handy by recognizing that situational variables do not need to be all either favourable or adverse in their entirety, and might accordingly vary between favourable, less favourable, or adverse. Accordingly, while we move to the right some situational variables might still be characterized as moderate in their severity and risks, and others could still be under favourable conditions. Accordingly, the preferred leadership behaviour and styles could be identified based on the Precedent Determinant for each situational variable (i.e. the circles numbered from 1 to 8 along the two vertical lines). The Precedent Determinants, as the name implies, assist in determining the onset of transitioning between, or simultaneously exhibiting, multiple leadership styles. The mechanism of the Precent Determinants, and how they facilitate the identification of the inception of leadership style change, can be properly explained through the story-telling style presentation of specific practical real-life scenarios S1, S2, S3, S4, S5, S6, S7, and S8. The presented scenarios are supported by the results of the qualitative data analysis, and the developed themes germane to leadership process and leadership styles.

Scenario S1: the project leader is running the project in the comfort zone and faces favourable situational conditions for the variables PC, TC&M, OS and EEFs, in addition to possessing formalized autonomy and power facilitated by a leadership-conductive organisational structure. In this scenario, located to the extreme left of the spectrum, the project leader can comfortably empower the team and align on project goals via transformational leadership, and can also actively or possibly support the whole team or subgroups based on their respective competencies.

Scenario S2: the project leader is scenario S1 starts to experience more challenging project tasks due to implications with stakeholders and also in team conditions due to the loss of competent and experienced team members either due to recruitment by functional departments who run more complex projects or as a reason of higher staff turnover driven by the attractive salaries in the market. Similar cases, to different levels of severity, were mentioned by interview participants from the Middle East (i.e. PC and TC&M move to the right). In this case, points 1 and 3 along the Precedent Determinants vertical line determine the movement of situational factors towards the right according to their relative severity. The inception determining factors, hence the name Determinants, of the movement towards the right could be setup based on qualitative or quantitative parameters such as a proprietary, or industry accepted, project complexity classification and team project maturity level. The definition and implementation of such qualitative or quantitative parameters, which ultimately assist in setting up the onsets points of leadership style(s) transitioning, presents considerable potential for future research towards making the model more descriptive and comprehensive. As the points move in the right direction, the project leader can objectively exhibit balanced leadership styles (i.e. along the amber area) until point 1 reaches point 2 or point 3 reaches point 4. The latter two cases might then trigger the onset of switching to full directive style, or a combination between directive and transformational leadership, based on the prescribed defining parameters of points 2 and 4. Any improvement in situational factors might potentially kick points 2 and 4 towards the left in the direction of points 1 and 3. Technically, this resembles the movement of leadership behaviour along a continuous spectrum rather than jumps onto discrete leadership styles, hence the description of the variability in the situational factors and leadership behaviour in the model using the term spectrum.

Scenario S3: the project leader faces the remote possibility of a force majeure taking place in the form of the debilitating pandemic COVID-19. In this case, the situational variable EEFs drastically and unexpectedly moves to the extreme end of the spectrum towards the adverse conditions. Due to the high relative weight of the variable EEFs, in comparison with other situational variables, the onset of Precedent Determinant no. 7 is triggered (i.e. the defining trigger being the force majeure event which is commonly prescribed in engineering contract). Consequently, the situational leadership traverses the spectrum in the direction of authoritative leadership with selective exhibition of transformational leadership to maintain the morale of the team members. Similar cases highlighted by the qualitative research participants provided insights into the optimum balance between directive and transformational leadership styles, among other styles, to resolve the dauting issues normally associated with force majeure. In this respect, leadership styles shall adapt significantly when facing severe situational variables. These situations demand a unique combination of leadership qualities and styles, which are contingent on the crisis's nature and intensity. During severe crises such as pandemics or force majeure events, organisations need leaders who can adapt to the crisis effectively. The crisis response leadership principles suggest a methodology for preparing and managing such crises by aligning leadership styles with organisational culture. This alignment helps in selecting the right leader who can manage the crisis effectively (Bowers et al., 2017). For example, the COVID-19 pandemic, deemed aa force majeure event, has highlighted the limitations of generic force majeure clauses in contracts, particularly in public-private partnerships. Leadership during such times requires swift trust and a comprehensive revision of contract provisions to manage the crisis effectively. Leaders must be adaptable, in full control, and ready to renegotiate terms to sustain project viability and integrity (Casady & Baxter, 2020). The COVID-19 pandemic has required leaders to be more transformational, effective, and authentic while maintaining a reasonable degree of authority to keep suffering projects under control. These leadership styles are crucial in managing crises by fostering a sense of direction, motivation, and moral support among employees (Ajemba, 2022).

Scenario S4: the project leader, who has category 4, is assigned to a multi-disciplinary complex project in a different region and temporarily relocates to a region with different organisational structure (due to the nature of the projects in that area) and national culture. The organisational structure does not follow other regions in being projectized but involves functional managers horizontally. The project leader realizes that this deviated setup attracts more powerplay and conflict among resource allocation. In this scenario, the situational variable OS moves to the right due to the challenging organisational structure. The project leader accordingly opts for more directive styles during the execution of the project, but also exhibits a balance between transformational and active supportive leadership during the initiation and planning phases of the project. Relatedly, the change of the national culture of the team members poses a challenge and demands transformational and supportive leadership styles. As noticed, scenario 4 leads of the importance of adding another dimension to leadership behaviour, namely variability over the project's life cycle and phases as described in the VH2D model in the next section.

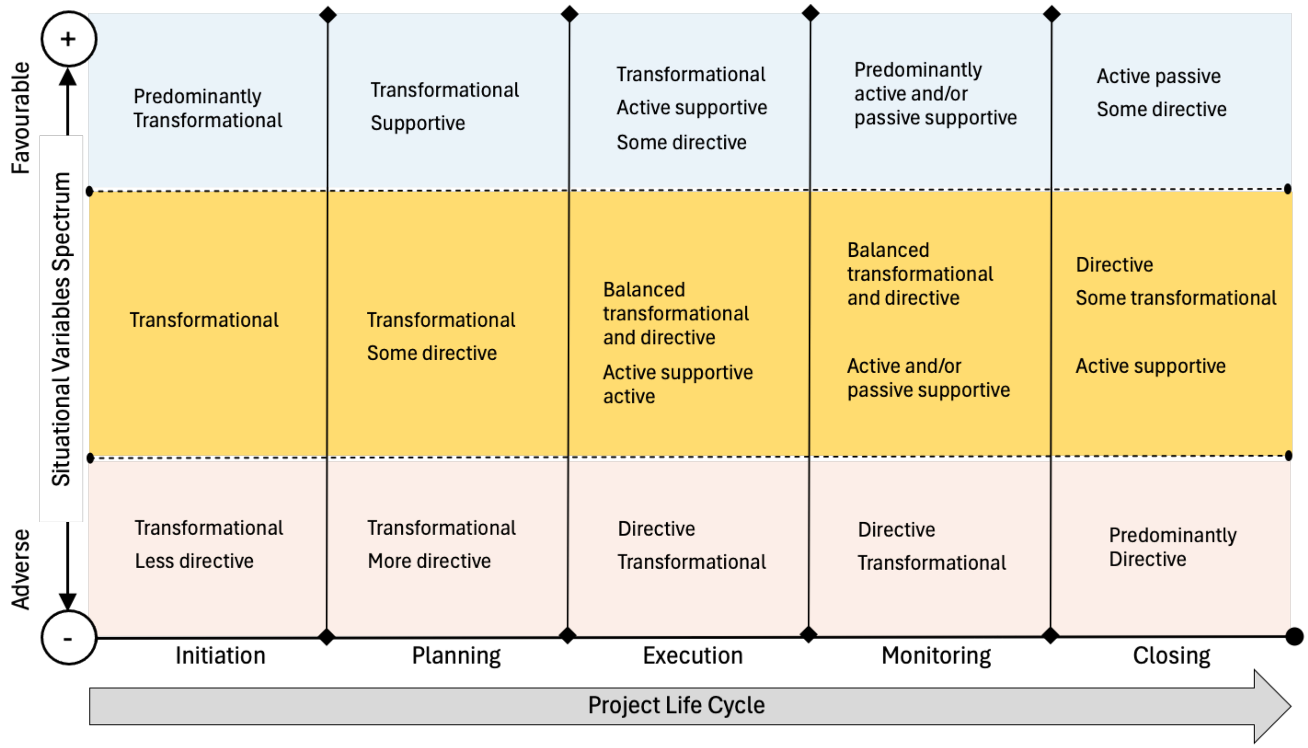
5.1.4 The VH2D Model

The VH2D model which borrows its acronym from the terms vertical, horizontal, and two-dimensional (2D) represents the epitome of capturing the variability in the situational variables and the corresponding contingency of leadership behaviour and styles temporally over the project's life cycle and phases as demonstrated in Figure 5.4.

As illustrated, the situational variables spectrum is projected on the vertical axis whereas the horizontal axis encompasses the well-known project process groups (PMI, 2017) that are used to emulate industry-standard project phases. The innovative projection of the situational variables spectrum along the vertical axis establishes a linkage between the Leadership Spectrum model and the VH2D model.

Figure 5.4

The VH2D model applicable to the AEC industry



Expectedly, the complexity and variability of the project conditions naturally increase as we move along the horizontal axis toward the right, particularly for mega and giga construction projects. As clearly seen in Figure 5.4, the model consists of 15 regions that have distinctive leadership styles which were prescribed following the quantitative and qualitative data analysis and theme development. Unlike the case for the 4Q-I, 4Q-II, and Leadership Spectrum, persistent situational conditions – whether favourable or adverse – do not necessarily warrant the implementation of the same leadership styles since styles are now contingent to project phases (as one moves in time along the horizontal axis towards the right). For example, the upper band in blue colour, which consists of 5 regions, captures the change in, and transition between, the preferred leadership styles for relatively consistent favourable project conditions but for different project phases. In this respect, since the VH2D model predicts contingency to project phases, the preferred leadership styles dynamically change as we move in time from the initiation stage to the closing stage of the project. Similarly, a project suffering from adverse conditions, normally rests along the red bank, would likely require dynamic change in leadership behaviour for each project phase even if situational factors do not dramatically improve. The middle band shown in amber colour depicts balanced approach leadership styles subject to the variability over the project's life cycle. It can be noticed that the colours (i.e. red, amber, blue) used in the VH2D model to represent the variability of the situational factors corresponding the same colours used in the Leadership Spectrum model. As such, the VH2D model can be technically conceived as a projection of the Leadership Spectrum model into a third new dimension, namely the project life cycle which is time-dependent and moves in one direction (i.e. time is irreversible). To that end, the substantive models so far portray the legitimacy and convergence of leadership behaviour and styles towards multi-dimensionality, which again raises the concern about the critical gap in contemporary studies that partially or completely ignore the multidimensional construction of leadership phenomenon as previously discussed in Chapters 2 and 4.

The justification of adding the project life cycle dimension might be argued by proponents of model simplification; however, this research recognizes that such addition is not complementary but mandatory for the purpose of formulating practical applicable models. Leadership styles must be adaptable and responsive to the different phases of a project (PMI, 2017). Ideally, these phases each present unique challenges and requirements that can significantly influence leadership behaviour. During the initiation phase, visionary and strategic leadership styles are crucial. Leaders need to establish clear goals, build initial frameworks, and ensure that all stakeholders are aligned and committed. This requires a combination of transformational and charismatic leadership to inspire and motivate the project team (Azman et al., 2020). In the planning phase, analytical and directive leadership styles become prominent. Leaders must focus on setting detailed roadmaps, defining resource allocations, and establishing risk management protocols. This requires meticulous attention to detail and the ability to guide the team through complex planning processes efficiently (Thomas & Buckle-Henning, 2007). Leadership during the execution phase shifts towards being more participative and supportive, but remains contingent to situational variables primarily project complexity and team characteristics as evident in the qualitative data. Leaders must facilitate collaboration, empower team members, and maintain motivation across the project team. This often requires a blend of democratic and transformational leadership styles to ensure effective implementation and adaptability to project dynamics (Ahmed et al., 2023). The monitoring phase, also known as monitoring & controlling (PMI, 2017) demands a high level of vigilance and situational leadership. Leaders need to continuously assess project progress against the benchmarks, make necessary adjustments, and respond to any emerging challenges. This phase often requires a mix of active and passive supportive leadership, transformational leadership, and sometimes transactional styles, to effectively manage changes and ensure project alignment with its objectives (Thite, 2000). In the closing phase, balanced leadership ensures reflective and consolidative performance and control, despite the occasional need for directive styles to avoid scope creep (i.e.

prolonged completion of snag lists) during the closing stage which is quite common in the AEC industry. Therefore, project leaders must ensure that all project aspects are properly concluded, snag lists are completed, lessons learned are documented, and project benefits are realized. Accordingly, this phase might often require a return to more transformational leadership to celebrate successes and prepare the team for future challenges.

Comparatively, recent scholarly literature has developed theoretical frameworks and models to understand the mechanisms of directive and transformational leadership styles, particularly in the context of the AEC industry. These frameworks consider the complexities of projects, team characteristics, internal organisational structures, and external environmental factors. Moreover, some accounts have introduced several models and theoretical frameworks to understand the nuances of directive and transformational leadership styles. For example, Tijani et al. (2021) developed a multi-level mental health management framework for project management practitioners in AEC project organisations. This model integrates organisational design theories, including institutional theory, agency theory, resource-based theory (RBT), contingency theory, and complexity theory, highlighting how these organisational, project, and external environmental factors contribute to mental health management in AEC project organisations. This framework underscores the relationship between leadership styles and mental health outcomes in the AEC sector, reflecting the importance of supportive leadership in complex project environments. Leifer and Delbecq (1978) developed a theoretical framework for analysing the determinants and functions of activity at the boundaries of organisations, including how internal and external organisational factors conceptualize the process of boundary spanning. This model relates to directive leadership in managing the AEC industry's external interactions, such as negotiations with stakeholders or compliance with regulations, emphasizing how external and internal organisational environments shape leadership behaviours (Leifer & Delbecq, 1978). Regarding complexity, Schneider and Somers (2006) contrasted General Systems Theory with Complexity Theory to develop implications for leadership research, proposing that leadership in Complex Adaptive Systems (CAS) may affect organisations indirectly through organisational identity and social movements. This perspective aligns with transformational leadership in AEC projects, where the complex interplay of various project and environmental factors necessitates a more adaptive, emergent form of leadership behaviour. Turner and Baker (2017) presented a leadership development model utilising the self-organising, managing, and regulating functions in teams and small groups, especially relevant for complex and unpredictable environments like those found in the AEC industry. This model connects with directive and transformational leadership by incorporating naturally occurring team processes to replicate leadership development characteristics (Turner & Baker, 2017). Relatedly, Gumusluoglu and Ilsev (2009) proposed a model assessing the impact of transformational leadership on creativity and innovation at both individual and organisational levels in the AEC industry. Their findings suggest that transformational leadership enhances creativity among employees and fosters organisational innovation, mediated by psychological empowerment. This model highlights the importance of transformational leadership in driving innovation within complex and dynamic project environments. Hala et al. (2020) explored the integration of Augmented Reality (AR) in construction, proposing a model-centric approach that aligns with the shift towards Building Information Modelling (BIM). This approach underscores the role of directive leadership in managing the integration of new technologies and the transformational leadership required to navigate the industry-wide changes brought about by digital transformation. Similarly, Mesu et al. (2015) investigated the impact of transformational leadership on organisational commitment in SMEs within the AEC industry. Their study highlights how directive leadership can strengthen the positive relationship between transformational leadership and organisational commitment, suggesting a nuanced interplay between these leadership styles in different organisational settings. Evidently, the results obtained in the current research, which signify the importance of directive leadership and its inextricable interrelation with transformational leadership, largely agree with the findings in the account by Mesu et al. (2015). The aforementioned example models and frameworks provide a view of how directive and transformational leadership styles are implemented and evolve in response to various factors in the AEC industry. They illustrate the dynamic interplay between leadership behaviour and the multifaceted nature of project management within this sector. They also demonstrate a nuanced understanding of leadership behaviours in the AEC industry, considering the interplay of project complexity, team dynamics, organisational structure, and external environmental influences.

5.2 Recommendations for Future Research

The current research has some limitations and calls for further research in many aspects. The key limitations primarily stem from feasibility and timeframe constraints. Firstly, the research is cross sectional. Secondly, although the study sample is deemed as representative, it merely came from one case study engineering firm who has global offices. Thirdly, the research was predominantly qualitative; hence employed simplistic quantitative and statistical analysis only. Although this is plausibly justified due to the nature of the research subject, being the exploration of a complex and multi-dimensional social phenomenon, it could still be claimed as a limitation by proponents of quantitative research, and those who hold positivist ontological and epistemological worldviews towards more determinism and less towards constructionism. Fourthly, the final qualitative data sample included twenty-seven (27) participants, namely senior project managers and directors, from different geographies and national cultures due to timeframe limitations. Although the size of the qualitative data sample compares well with other contemporary studies as described in Chapters 2 and 3, a larger sample would have potentially led to more substantiation of the results. Based on the aforesaid study limitations, recommendations for future research are succinctly described below.

(a) Longitudinal studies to explore the change of leadership behaviour and attitude over the life cycle of projects; not address leadership in the past tense but acquire the opportunity to investigate leadership dynamic behaviour in real time. This will potentially facilitate more in-depth analysis of the precedent determinants concept, and accordingly allow researchers to zoom in into the variable and factors that play a key role in the change of leadership styles.

(b) Seek further statistically significant study sampling by including more case study engineering firms from different geographies.

(c) Larger size and demographically diversified qualitative data sample. This can ensure a sample with higher heterogeneity and statistical significance. Therefore, it is recommended that future sample sizes (net sample size after response) should not be less than the size required to achieve 95% level of confidence. If the population sample is unknown, then it is recommended to use suitable statistical formulae to estimate the adequate size of a statistically significant sample.

(d) Employment of more extensive quantitative analysis and employment of advanced statistical techniques.

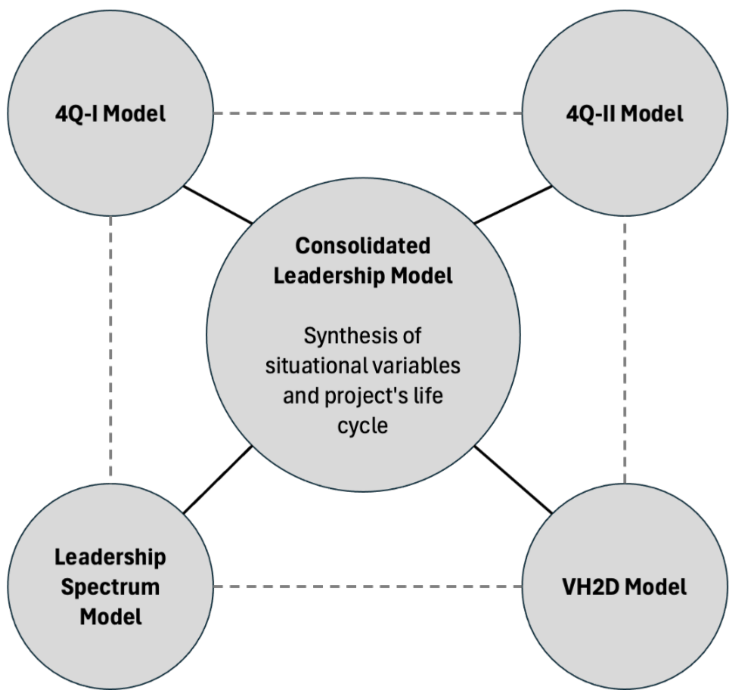
(e) Data integration using mixed methods rather than methodological triangulation.

(f) For 4Q-I model, the horizontal axis features *team competency and maturity*. This variable can be further elaborated in a dedicated study, in a similar fashion to the well-established project management maturity (PMM) model, so it can measure the various applicable and more pertinent dimensions of competency and maturity levels to enable rigorous correlation between team characteristic and the leadership styles proposed under each quadrant. Alternatively, existing models can be used to categorize team maturity based on various criteria and parameters.

(g) There is further potential to substantiate and expand the developed models. Additionally, merging the models, namely 4Q-I, 4Q-II, Leadership Spectrum, and VH2D, into one holistic model is an intriguing area for future research since the four models are inherently interlinked. For instance, it is recommended to attempt such connection between the models by establishing classification criteria for the independent and extraneous variables, and subsequently combining all variable into a single model that can predict the optimum leadership styles for each project phase over the life cycle. This novel formulation allows the rationalization and study of leadership for an additional variable (life cycle) whist synthesizing the influence of other variables including project complexity, team characteristics, organisational structure, and external environmental factors all together under one all-inclusive theoretical framework. This resembles the creation of a web-model, as depicted in Figure 5.5., where substantive models are conscientiously combined to produce one model of practical relevance. As mentioned earlier, the substantive models are interlinked as depicted in the dashed lines in Figure 5.5.

Figure 5.5

Web-model: synthetization and consolidation of the substantive models



(h) The variables accounted for in the substantive models are deemed to encompass the majority of variables encountered in real-life applications. Nevertheless, future research could explicitly examine other variables to focus on their respective influence on leadership behaviour and style. Alternatively, future studies could focus on one of the independent variables and expand its dimensions to navigate their respective impact.

For example, a scholarly study could be exclusive to the influence of project complexity on leadership behaviour and styles. In this respect, the research can delve into the various potential dimensions of project complexity to evaluate their respective correlation with leadership phenomenon. Likewise, other studies could focus on team characteristics which by itself is likely to require several studies to adequately cover its variability and the myriads of dimensions encapsulated in it.

(i) Future research can focus on defining the parameters associated with the Precedent Determinants, featured in the Leadership Spectrum model, in order to practically enable project leaders to identify onset conditions of dynamic leadership. For example, further research can focus on defining and quantifying project complexity parameters that influence project leadership to assume different avenues and change their leadership styles. Similarly, other the defining parameters for the team characteristic situational variable could be examined under and independent study. Clearly, the precedent determinants alone potentially open doors for considerable future research that could involve leadership and management theory, organisational design, and probably other closely relevant domains of social science.

(j) Future research can explore the contribution of other leadership style and establish connection with the ones used in the current research as applicable. For example, future research can systematically look at and examine servant, charismatic, and authentic leadership styles, among many others styles applicable to the AEC industry only, since a wider non-focused approach is likely to be impractical and possibly unrealistic.

Furthermore, future scholarly research can expand on the aforesaid themes by addressing specific gaps and emerging trends. Existing research emphasises the importance of leadership competencies in sustainable construction projects, particularly transformational leadership qualities that drive sustainability goals (Tabassi et al., 2016). Future research could investigate how emerging leadership styles, like authentic and servant leadership, influence the adoption and effectiveness of sustainable practices in the AEC industry. Moreover, the increasing trend in adopting technologies like Building Information Modelling (BIM) and Extended Reality (XR), signals the need for exploring how these technologies reshape leadership roles and competencies. In this respect, existing literature has started to address the role of leadership in managing technological transitions (Alizadehsalehi et al., 2020), but more detailed studies could focus on specific leadership behaviours that facilitate or hinder technological integration in project management. Additionally, leadership in the AEC industry shall also adapt to global and multicultural project environments. Future research could focus on how leadership styles vary across different cultural contexts and how these variations affect project success. This would build upon existing studies that emphasise the need for leadership competencies that align with diverse team dynamics and project goals (Toor & Ofori, 2008). From another perspective, the AEC industry faces frequent changes and crises, such as economic downturns, regulatory changes, and now pandemics. Research could expand on how leadership styles such as crisis leadership or adaptive leadership influence project resilience and adaptability. This would be an extension of studies on leadership competencies in dynamic environments (Gunhan, 2019). Worth noting, different project delivery methods, such as Design-Build or Integrated Project Delivery, might require different leadership styles. While existing literature touches on the competencies required for successful project management, future studies could specifically analyse how leadership styles influence the choice and success of various project delivery methods. In summary, the potential for future research is enormous and could range from standalone doctoral studies to wider complicated research programmes that more comprehensively explore leadership phenomenon in the AEC industry. The investment in such large research programmes is absolutely justified given the significant importance of the AEC industry in improving the quality of life and its contribution to national gross domestic product of both developing and developed countries.

5.3 Conclusions

The research explored project leadership for the case of AEC industry, introducing novel leadership models tailored to this sector's unique demands. The research affirms the importance of directive leadership in managing complex projects and crisis situations effectively, ensuring successful project delivery by maintaining control. The directive leadership behaviour is shown to be largely independent of factors like the leader’s gender and national culture, suggesting its broad applicability as corroborated through inferential statistics and the results from the qualitative data analysis.

The research also highlights the benefits of a balanced approach between directive and transformational leadership, promoting optimal project outcomes. This balance, however, is noted to be more achievable under ideal project conditions rather than challenging ones. In contrast to existing literature which often views transformational leadership as universally optimal, this dissertation presents a nuanced view where leadership effectiveness is contingent on project-specific factors such as complexity and team dynamics.

Furthermore, the study introduces the concept of dynamic leadership, which involves fluidity in leadership styles to adapt to changing project conditions. This approach not only covers the selection of appropriate leadership styles for particular situations but also includes the capability for leaders to transition between styles as project conditions evolve. The research underscores the inadequacy of static, leader-centric models in addressing the dynamic and multifaceted nature of project management within the AEC industry.

The dissertation proposes four substantive leadership models derived from the research findings, designed to be practically applicable in the AEC industry, namely the Four Quadrant I (4Q-I), Four Quadrant II (4Q-II), Leadership Spectrum, and VH2D model. These models integrate various situational variables that influence leadership behaviour in project management. The 4Q-I model categorizes leadership styles based on project complexity and team competency. It suggests directive leadership in high complexity scenarios with less competent teams, and more balanced, transformational leadership in less complex situations with highly competent teams. The 4Q-II model focuses on the impact of organisational structure and external environmental factors on leadership styles. This model advocates for more directive leadership in rigid organisational structures with adverse external conditions, and more transformational or supportive leadership in flexible, empowering structures despite challenging external environments. These two models categorize leadership responses into quadrants based on the intensity and nature of these factors, offering a structured approach to selecting appropriate leadership styles. The Leadership Spectrum model offers a comprehensive framework that encapsulates the variability of situational factors along a continuum, highlighting the dynamic shift between different leadership styles as project conditions change. Effectively, this model synthesizes the insights from the 4Q models, presenting a continuum of leadership styles that vary from directive to transformational based on a spectrum of situational variables. It highlights the fluidity required in leadership approaches, accommodating the gradual shifts in project conditions that demand corresponding adjustments in leadership style. Lastly, the VH2D model represents a sophisticated, and more holistic, integration of the variability in situational factors over the project life cycle, emphasizing the need for different leadership styles at different stages of the project. These models are intended to provide AEC industry leaders with tools to adapt their leadership approach flexibly and effectively according to varying project demands and conditions. Expanding on the Leadership Spectrum Model, the VH2D model incorporates the temporal dimension, mapping how leadership styles should evolve through different phases of the project lifecycle. This model illustrates how the variability in situational factors and the corresponding leadership responses unfold over time, emphasizing the need for dynamic leadership throughout the project duration.

The concept of dynamic situational leadership, central to the current research, emphasises the adaptability of leadership styles to the ever-changing contexts within project management in the AEC industry. This approach is predicated on the recognition that static leadership models do not suffice in addressing the complex, variable, and dynamic nature of modern construction projects. Instead, leaders must be equipped to shift their leadership styles fluidly in response to evolving project demands, team dynamics, organisational structures, and external environments. Dynamic situational leadership is not merely about choosing the right style for a particular context but also about the leader's ability to transition between styles as situational variables change. This form of leadership is critical in the AEC industry where projects are susceptible to various influences including technological advancements, regulatory changes, and economic fluctuations. For example, a leader might need to adopt a directive style during the initial stages of a project to set clear objectives and parameters but shift to a more transformational approach as the project progresses to inspire innovation and adapt to emerging challenges. The study also brings forth the novel concepts of leadership style concurrency and precedent determinants as described in the Leadership Spectrum model. Leadership concurrency concerns the ability of leaders to exhibit multiple leadership styles simultaneously to address diverse needs within the project team. The precedent determinants are indicators that prompt or predict the need for a transition in leadership style, based on the evolving nature of project variables. Most importantly, the four substantive leadership models developed from the research findings are not standalone concepts but are deeply interrelated, each addressing different aspects of leadership adaptability. Together, these models create a comprehensive framework for dynamic situational leadership in the AEC industry, providing a nuanced understanding of how various factors influence leadership behaviour and how these influences change over the course of a project. By integrating these models, leaders in the AEC industry can be better equipped to handle the complexities and challenges inherent in modern project environments, leading to more effective management practices and successful project outcomes. This holistic approach underscores the dissertation’s contribution to advancing leadership theory and practice within the context of AEC project management, setting the stage for further research and application in this vital field.

Given the evolving nature of the AEC industry and the complex interplay of factors affecting project management, the current research identifies several areas for future research. For example, longitudinal studies are suggested to better understand how leadership behaviour evolves over the lifecycle of a project and to validate the dynamic leadership models proposed. Additionally, including more diverse case studies (e.g. global engineering firms) and employing advanced statistical techniques could deepen the understanding of leadership dynamics in different contexts. The impact of emerging technologies and practices, such as Building Information Modelling (BIM) and sustainable construction, on project leadership could also be investigated. Furthermore, exploring how different cultural contexts and international project environments influence leadership styles and project success presents promising research opportunities. The synthesis of the consolidated models, presented in this research, can be employed to create tools and instruments that can practically assess and guide leadership behaviour according to the unique characteristic of project phases; hence help project leaders in achieving more effective leadership throughout project life cycle.

Furthermore, the outcome of this study could open ample space for future research by either separately or collectively exploring the various dimensions of leadership. For instance, longitudinal research could potentially look at a project leader’s behaviour over the entire project life cycle by mapping each project phase to the dynamics of leadership attitudes and behaviour. This exercise could also be performed for different engineering sectors to identify any variability and correlation with the sector itself. As a matter of fact, some sectors such as nuclear and hydropower might be more demanding than others due to their criticality (i.e. need to supply power by a certain date; hence exerting pressure on project leaders to be more commanding in order to meet stringent deadlines. As such, the variables to be examined could vary widely; therefore, future research should carefully consider a prudent selection and grouping of independent variables (i.e. under a single theoretical framework) in order to formulate meaningful, non-trivial, models that are academically sound but also practically relevant and useful to the AEC industry.

Furthermore, a potentially new concept devised by the author of this thesis is known as Leadership Quantum Analysis (LQA) and could ambitiously induce extensive research in the domain of quantitative analysis of leadership behaviour. The concept hinges on the multidimensionality of leadership as a social construct, yet largely differs from the extant quantitative research because it measures leadership itself rather than the attempt to examine leadership by measuring its influence on the followers. Essentially, leadership can be explored in many ways, but mostly qualitatively. The extant quantitative analysis does not directly look into leadership but rather statistically examines its impact in terms of team performance, project outcomes, and follower's perception, among other things. Instead, leadership performance metrics, quantum metrics, that are directly linked to the project leader can be established and measured to study the dynamics of leadership behaviour. The aforesaid concept is challenging and cannot be prematurely developed before establishing and validating meaningful measurable quantum metrics.

The conclusions of this research underscore the centrality of dynamic situational leadership in the AEC industry, highlighting its necessity in addressing the complexity, variability, and temporal evolution of projects. The four substantive leadership models proposed—4Q-I, 4Q-II, the Leadership Spectrum, and VH2D—collectively provide a theoretical and practical framework for understanding and operationalising leadership adaptability across diverse project environments. Yet, these contributions simultaneously expose areas requiring further scholarly investigation, which are reflected in the recommendations for future research.

Firstly, the conclusion that leadership effectiveness is contingent upon project-specific variables such as complexity, team competency, and organisational context directly informs the recommendation for longitudinal studies. While this study confirms the need for leaders to fluidly transition between directive and transformational styles, only longitudinal research can empirically validate how these transitions unfold over the extended periods and longer project life cycles. As such, the recommendation operationalises the conceptual insight into a methodological pathway that can capture leadership behaviour “in real time” rather than retrospectively.

Secondly, the acknowledgement in the conclusions that directive leadership exhibits broad applicability across diverse cultural and organisational settings strengthens the recommendation and rationale for a broader and more statistically significant sampling. Although the case study approach was justified and yielded rich data, the conclusions suggest that generalisability across different firms, geographies, and project environments is crucial. A larger, demographically diverse sample, supported by advanced statistical analysis, would enable validation of the models across contexts, thus substantiating their external validity.

Thirdly, the conclusions highlight the interrelated nature of the four substantive models, where each captures a different dimension of leadership adaptability. This provides a clear impetus for the recommendation to synthesise the models into a holistic framework. The proposal to merge the models into a web-based construct reflects the conclusion that no single static model suffices in capturing the multidimensional nature of leadership; instead, an integrated, lifecycle–oriented model is necessary for enhanced practical relevance.

Fourthly, the discovery of the “precedent determinants” concept and “leadership concurrency”, or coexistence of multiple leadership styles, in the conclusions directly aligns with recommendations (i) and (h). The call for future research to define and quantify these determinants is rooted in the recognition that leaders require tangible indicators to guide the timing and nature of their leadership transitions. Similarly, the recommendation to examine independent variables such as project complexity and team characteristics in greater depth is directly linked to the conclusion that these are pivotal situational factors underpinning leadership adaptability.

Additionally, the conclusions recognise the importance of adaptability not only in terms of leadership style but also in response to external influences such as technological change, sustainability mandates, and multicultural team environments. This directly links to the recommendations concerning “emerging leadership styles”, and the exploration of leadership in contexts shaped by technological adoption (e.g. BIM) and sustainability agendas, among others. These recommendations are natural extensions of the study’s conclusion that static leader-centric leadership models are surely inadequate.

Finally, the novel proposal of the Leadership Quantum Analysis (LQA) resonates with the study’s overarching conclusion that leadership should be conceptualised as a dynamic, measurable construct. While the dissertation has advanced leadership theory qualitatively through its four models, the introduction of LQA extends this ambition by calling for a new quantitative paradigm—one that measures leadership itself rather than merely its effects on outcomes. This recommendation therefore arises organically from the dissertation's recognition of the limitations of extant positivist approaches, while simultaneously embracing their potential if reconceptualised.

In sumumary, the recommendations for future research are not ancillary suggestions but are integrally derived from, and anchored in, the conclusions of the current study. They constitute the natural progression of the theoretical, methodological, and practical contributions of this research. Where the conclusions establish the necessity, form, and utility of dynamic situational leadership in the AEC industry, the recommendations delineate the avenues through which future scholarship may extend, validate, and operationalise these insights into a more robust, holistic, and empirically grounded body of knowledge.

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Appendix A

UREC Provisional Approval

Unicaf University Research Ethics Committee Decision

Student's Name: Yousef Moh'd Yousef Alsoudani

Student's ID #: R1909D9248719

Supervisor's Name: Dr Mary Mutete Mwanzia

Program of Study: UU-DBA-900-1-ZM

Offer ID /Group ID: O26027G26727

Dissertation Stage: DS 1

Research Project Title: IMPLEMENTATION OF A NOVEL DYNAMIC AND MULTIDIMENSIONAL LEADERSHIP MODEL FOR ENGINEERING AND CONSTRUCTION PROJECT MANAGEMENT

Comments: No comments

Decision*: A. Provisionally approved without revision or comments

Date: 24-Jun-2021

*Provisional approval provided at the Dissertation Stage 1, whereas the final approval is provided at the Dissertation stage 3. The student is allowed to proceed to data collection following the final approval.

Appendix B

UREC Final Approval

Unicaf University Research Ethics Committee Decision

Student's Name: Yousef Moh'd Yousef Alsoudani

Student's ID #: R1909D9248719

Supervisor's Name: Dr. Mary Mutete Mwanzia

Program of Study: UU-DBA-900-3-ZM

Offer ID /Group ID: O39249G44977

Dissertation Stage: DS3

Research Project Title:

IMPLEMENTATION OF AN INNOVATIVE DYNAMIC AND MULTIDIMENSIONAL LEADERSHIP MODEL IN PROJECT MANAGEMENT: A CASE STUDY OF THE ENGINEERING AND CONSTRUCTION INDUSTRY

Comments: No comments.

Decision*: A. Approved without revision or comments

Date: 10:39pm 22 Feb 2023

*Provisional approval provided at the Dissertation Stage 1, whereas the final approval is provided at the Dissertation stage 3. The student is allowed to proceed to data collection following the final approval.

Appendix C

Approved Research Ethics Application Form (REAF)

UNICAF UNIVERSITY
RESEARCH ETHICS APPLICATION FORM
DOCTORAL STUDIES PROVISIONAL APPROVAL

The Provisional Approval - Research Ethics Application Form (REAF) should be completed by Doctoral level candidates enrolled on Dissertation stage 1.

This form is a **provisional approval** which means that the UREC committee has accepted the initial description of the project but this is conditional as changes may have to be implemented following Dissertation Stage 2 and piloting in Dissertation Stage 3.

This is a conditional offer and acceptance of the project needs to be verified and confirmed upon completion of the Research Ethics Application Form in Dissertation Stage 3.

Important Notes:

- An electronic version of the completed form should be uploaded by the student to the relevant submission link in the VLE. Student's supervisor will then review the form and provide feedback commentary. Once supervisor's initial approval is given then the supervisor will forward this to doctoral.studies-aa@unicaf.org, for provisional approval by the Unicaf University Research Ethics Committee (UREC).

- Please type your answers and **do not** submit paper copy scans. Only *PDF* format documents should be submitted to the committee. It is recommended to use free version of Adobe Acrobat Reader available online: https://get.adobe.com/reader/

- If you need to supply any supplementary material, not specifically requested by the application form, please do so in a separate file. Any additional document(s) should be clearly labelled and uploaded in the relevant VLE link.

- If you have any queries about the form, please address them to your dissertation or project supervisor.

UNICAF UNIVERSITY

UNICAF UNIVERSITY
RESEARCH ETHICS APPLICATION FORM
DOCTORAL STUDIES PROVISIONAL APPROVAL

UREC USE ONLY:
Application No:
Date Received:

Student's Name: Yousef ALSoudani

Student's E-mail Address: yousef.soudani@gmail.com

Student's ID #: R1909D9248719

Supervisor's Name: Mary Mutete Mwanzia

University Campus: Unicaf University Zambia (UUZ)

Program of Study: UUM: DBA - Doctorate of Business Administration

Research Project Title: Implementation of an innovative dynamic and multidimensional leadership model in project management

1. **Please state the timelines involved in the proposed research project:**

Estimated Start Date: 21-May-2021 Estimated End Date: 17-Oct-2021

2. **The research project**

2a.Project Summary:

In this section please fully describe the purpose and underlying rationale for the proposed research project. Ensure that you pose the research questions to be examined, state the hypotheses, and discuss the expected results of your research and their potential.
It is important in your description to use plain language so it can be understood by all members of the UREC, especially those who are not necessarily experts in the particular discipline. To that effect please ensure that you fully explain / define any technical terms or discipline-specific terminology (maximum 300 words +/- 10%).

The extant literature on leadership in engineering project management suffers from gaps, fragmented theoretical formulations, and overlapping concepts. Evidently, practical implications are having "less than desired" impact since numerous large global projects are still lacking leadership; and are failing behind schedule with cost overruns. As such, the study empirically explores leadership phenomenon in project management for the specific case of the engineering and construction industry. The research questions are articulated below.
I. What are the existing gaps in theoretical literature and professional research in relation to the lack of innovative treatment of leadership as a dynamic and multidimensional phenomenon for the specific case of the engineering and construction industry?
II. Which distinctive leadership styles are dominantly demonstrated by project managers in leading complex engineering and construction projects?
III. Does a project manager dynamically exhibit multiple leadership styles over the life cycle of the project, and how/when a project manager deliberately decides to do so?
IV. How can the innovative treatment of leadership as a dynamic and multidimensional phenomenon be culminated in formulating a substantive leadership model of practical relevance to project managers who lead complex engineering and construction projects.

2b. Significance of the Proposed Research Study and Potential Benefits:

Outline the potential significance and/or benefits of the research (maximum 200 words).

The study attempts to formulate a dynamic and multidimensional leadership model of practical relevance to help engineers in optimally leading complex projects and improving project performance. The model can be used as a management and leadership tool to guide practicing engineers. In this respect, few simplistic leadership models are available in professional literature such as the four quadrant model, however; these models resemble the treatment of a particle's motion in space as one dimensional and static, therefore, I argue that such models have limited useful applications, particularly for complex multi-stakeholder projects. In contrast, the contemplated model explores the situational, dynamic (time-varying), and multidimensional nature of leadership, as a social phenomenon, in the specific case of engineering project management, and employs such realization to capture, and understand, the mechanisms of how leadership styles are contextually exhibited and exploited by engineers over the life cycle of the project.

3. **Project execution:**

3a. Type of project. The following study is an:

- [x] experimental study (primary research)
- [ ] desktop study (secondary research)
- [ ] desktop study using existing databases involving information of human/animal subjects
- [ ] Other

If you have chosen 'Other' please Explain:

3b. Methods. The following study will involve the use of:

Method	Materials / Tools
☑ Qualitative	☐ Face to Face Interviews ☑ Phone Interviews ☐ Face to Face Focus Groups ☐ Online Focus Groups ☐ Other*
☑ Quantitative	☑ Self-administered Questionnaires ☐ Online Questionnaires ☐ Experiments ☐ Tests ☐ Other *

*If you have chosen 'Other' please Explain:

4. Participants

4a. Does the Project involve the recruitment of participants?

☑ YES **If YES, please complete all following sections.**

☐ NO **If NO, please directly proceed to Question 5.**

Note: The definition of "participation" includes active participation, such as when participants knowingly take part in an interview or complete a questionnaire.

4b. Relevant Participant Details of the Proposed Research

Please state the number of participants you plan to recruit, and describe important characteristics such as: demographics (e.g. age, gender, location, affiliation, level of fitness, intellectual ability etc). It is also important that you specify any inclusion and exclusion criteria that will be applied (e.g. eligibility criteria for participants).

Number of participants: 300

Age range From 30 To 60

Gender
- ☑ Female
- ☑ Male

Eligibility Criteria:

- Inclusion criteria

  1. Current job position is project manager
  2. Past experience of at least 5 years in project management in the engineering industry
  3. Senior level, or middle level (case-by-case basis).

- Exclusion criteria

  People with mental disabilities are excluded. All participants (project managers) shall be able to read, understand, and sign the Consent Forms by themselves.

Disabilities: People with mental disabilities are excluded.

Other relevant information (maximum 100 words):

Other inclusion criteria include number of managed projects, project manager classification in the organization (e.g. category 1, 2, 3, etc), number of direct reports, number of subordinates (team size for each project), selection recommendations by executives and senior management, project type and complexity, status of the project (ongoing, completed, terminated, disputed, etc), among others.
Number of participants in interviews and SAQ is 30 and 300, respectively,.

4c. Recruitment Process for Human Research Participants:

Please clearly describe how the potential participants will be identified, approached and recruited (maximum 200 words).

Non-probability purposive sampling will be used to select the participants who are employees working for the same international engineering organization The study sample comprises 30 senior project managers and directors, chosen from different global offices (US, Europe, UK, Singapore, Middle East, India, and Philippines) and engineering sectors (construction, environment, water, design, etc). The researcher (an employee in the same organization) has access to the project management communities in aforesaid global offices. Potential participants will be identified and approached based on the researcher's social network, referrals, organization database (HR records of project managers), recommendations by senior directors and country managers on potential candidates. The researcher will directly contact and liaise with the proposed participants, then finalize the selection of the sample, and will subsequently share Consent Forms.

4d. Relationship between the principal investigator and participants:

Is there any relationship between the principal investigator (student), co-investigators(s), (supervisor) and participant(s)? For example, if you are conducting research in a school environment on students in your classroom (e.g. instructor-student).

☑ YES ☐ NO

If YES, please specify (maximum 100 words).

The principal investigator (doctoral student) works for the same organization from which the participants will be selected. Some participants are known coworkers whom the researcher is familiar with and had already established rapport. Other participants, from global offices, are either referred by other project managers, or executive management, or selected based on the sample selection criteria. Therefore, the relationship could be deemed as either employee-coworker or employee-employee.

5. Further Approvals

Are there any other approvals required (in addition to ethics clearance from UREC) in order to carry out the proposed research study?

☐ YES ☑ NO

If YES, please specify (maximum 100 words).

6. Potential Risks of the Proposed Research Study

Are there any potential risks, psychological harm and/or ethical issues associated with the proposed research study, other than risks pertaining to everyday life events (such as the risk of an accident when travelling to a remote location for data collection)?

☐ YES ☑ NO

If YES, please specify (maximum 150 words):

7. Application Checklist

Please mark √ if the study involves any of the following:

☐ Children and young people under 18 years of age, vulnerable population such as children with special educational needs (SEN), racial or ethnic minorities, socioeconomically disadvantaged, pregnant women, elderly, malnourished people, and ill people.

☐ Research that foresees risks and disadvantages that would affect any participant of the study such as anxiety, stress, pain or physical discomfort, harm risk (which is more than is expected from everyday life) or any other act that participants might believe is detrimental to their wellbeing and / or has the potential to / will infringe on their human rights / fundamental rights.

☐ Risk to the well-being and personal safety of the researcher.

☐ Administration of any substance (food / drink / chemicals / pharmaceuticals / supplements / chemical agent or vaccines or other substances (including vitamins or food substances) to human participants.

☐ Results that may have an adverse impact on the natural or built environment.

8. Final Declaration by Applicants:

(a) I declare that this application is submitted on the basis that the information it contains is confidential and will only be used by Unicaf University and Unicaf University Research Ethics Committee (UREC) for the explicit purpose of ethical review and monitoring of the conduct of the research proposed project as described in the preceding pages.

(b) I understand that this information will not be used for any other purpose without my prior consent, excluding use intended to satisfy reporting requirements to relevant regulatory bodies.

(c) The information in this form, together with any accompanying information, is complete and correct to the best of my knowledge and belief and I take full responsibility for it.

(d) I undertake to abide by the highest possible international ethical standards governing the Code of Practice for Research Involving Human Participants, as published by the UN WHO Research Ethics Review Committee (ERC) on http://www.who.int/ethics/research/en/ and to which Unicaf University aspires to.

(e) In addition to respect any and all relevant professional bodies' codes of conduct and/or ethical guidelines, where applicable, while in pursuit of this research project.

(f) I understand it is my responsibility to submit a full REAF application during Dissertation Stage 3 to UREC. If a REAF application is not submitted my project is not approved by UREC.

(g) I fully acknowledge that this form does not constitute approval of the proposed project but it is only a provisional approval.

☑ **I agree with all points listed under Question 8**

Student's Name: Yousef ALSoudani

Supervisor's Name: Mary Mutete Mwanzia

Date of Application: 24-May-2021

Important Note:
Please now save your completed form (we suggest you also print a copy for your records) and then submit it to your UU Dissertation/project supervisor (tutor). **In the case of student projects, the responsibility lies with the Faculty Dissertation/Project Supervisor.** If this is a student application, then it should be submitted via the relevant link in the VLE. Please submit only electronically filled in copies; **do not** hand fill and submit scanned paper copies of this application.

☑ **Before submitting your application, please tick this box to confirm that all relevant sections have been filled in and the information contained is accurate to the best of your knowledge.**

Appendix D

Gatekeeper Letter

Gatekeeper letter

Address: Saudi Arabia, Riyadh

Date: 10-Feb-2023

Subject: Participation in Interviews

Dear Sir,

I am a doctoral student at UniCAF University, Zambia Campus. As part of my degree, I am carrying out a research on leadership in project management, with a specific focus on the engineering and construction industry. Subject to approval by UniCAF Research Ethics Committee (UREC) this study will be using primary data collected through surveys, namely: Self-Administrated Questionnaire (SAQ) and interviews; mainly semi-structured and unstructured interviews with open-ended questions.

As such, I am writing to obtain your permission for distributing the SAQ to the project managers community (circa 300 recipients) and for undertaking one-to-one interviews with thirty participants (senior project directors and managers) who are identified based on the selection criteria outlined below (the items below are not exhaustive).
1. Seniority. More than 10 years of project management experience in any market sector.
2. Number of managed, completed or terminated, projects is above 5 (in any region).
3. Size of project team is above 3 for all previously managed projects.
4. Project type and size. Design or construction, complexity will considered on a case-by-case basis (project value above USD 1.0 million).

The interviews will be conducted during the period 04 March to 25 April 2023 (tentative timeline subject to modification based on ethics approval), PM local time for each region. The average duration of the interview is sixty minutes. I will arrange the interview time slots, in coordination with the participants, after obtaining consent from the participants who will sign an Informed Consent Form (ICF) that has been approved by UniCAF Research Ethics Committee (UREC).

Kindly let me know if you require any further information or clarifications, and thank you for your assistance.

Yours Sincerely,

Student's Name: Yousef AlSoudani
Student's E-mail: yousef.soudani@gmail.com
Student's Address and Telephone: Saudi Arabia. M +966591393934
Supervisor's Title and Name: Dr. Mary Mutete Mwanzia
Supervisor's Position: Doctoral Research Supervisor
Supervisor's E-mail: m.mwanzia@unicaf.org

Appendix E

Informed Consent Form

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Informed Consent Form

Part 1: Debriefing of Participants

Student's Name: Yousef Moh'd Yousef Alsoudani

Student's E-mail Address: yousef.soudani@gmail.com

Student ID #: R1909D9248719

Supervisor's Name: Dr. Mary Mutete Mwanzia

University Campus: Unicaf University Zambia (UUZ)

Program of Study: UUZ: DBA - Doctorate of Business Administration

Research Project Title: IMPLEMENTATION OF AN INNOVATIVE DYNAMIC AND MULTIDIMENSIONAL LEADERSHIP MODEL IN PROJECT MANAGEMENT: A CASE STUDY OF THE ENGINEERING AND CONSTRUCTION INDUSTRY

Date: 30-Nov-2022

Provide a short description (purpose, aim and significance) of the research project, and explain why and how you have chosen this person to participate in this research (maximum 150 words).

This empirical research aims at exploring the dominant leadership behaviors and styles exhibited by project managers, in the engineering and construction industry, to facilitate the formulation of an innovative leadership model which has practical significance in leading complex large projects.
As one of the interview participants, who are among the organisation's project management community, you have been purposively chosen based on a prescribed set of selection criteria including, among others, seniority, job role (i.e. as project director or manager), portfolio of projects under the participant's management, geography, and project performance metrics. The Global PgM Director directly assisted in the nomination of interview candidates; and contributed to the final selection of participants.

The above named Student is committed in ensuring participant's voluntarily participation in the research project and guaranteeing there are no potential risks and/or harms to the participants.

Participants have the right to withdraw at any stage (prior or post the completion) of the research without any consequences and without providing any explanation. In these cases, data collected will be deleted.

All data and information collected will be coded and will not be accessible to anyone outside this research. Data described and included in dissemination activities will only refer to coded information ensuring beyond the bounds of possibility participant identification.

I, Yousef Moh'd Yousef Alsoudani **, ensure that all information stated above is true and that all conditions have been met.**

Student's Signature: Yousef AlSoudani

UNICAF UNIVERSITY

Informed Consent Form

Part 2: Certificate of Consent

This section is mandatory and should to be signed by the participant(s)

Student's Name: Yousef Moh'd Yousef Alsoudani

Student's E-mail Address: yousef.soudani@gmail.com

Student ID #: R1909D9248719

Supervisor's Name: Dr. Mary Mutete Mwanzia

University Campus: Unicaf University Zambia (UUZ)

Program of Study: UUZ: DBA - Doctorate of Business Administration

Research Project Title: IMPLEMENTATION OF AN INNOVATIVE DYNAMIC AND MULTIDIMENSIONAL LEADERSHIP MODEL IN PROJECT MANAGEMENT: A CASE STUDY OF THE ENGINEERING AND CONSTRUCTION INDUSTRY

I have read the foregoing information about this study, or it has been read to me. I have had the opportunity to ask questions and discuss about it. I have received satisfactory answers to all my questions and I have received enough information about this study. I understand that I am free to withdraw from this study at any time without giving a reason for withdrawing and without negative consequences. I consent to the use of multimedia (e.g. audio recordings, video recordings) for the purposes of my participation to this study. I understand that my data will remain anonymous and confidential, unless stated otherwise. I consent voluntarily to be a participant in this study.

Participant's Print name:

Participant's Signature: ______________________

Date:

If the Participant is illiterate:

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had an opportunity to ask questions. I confirm that the aforementioned individual has given consent freely.

Witness's Print name:

Witness's Signature: ______________________

Date:

Appendix F

Quantitative Data Collection Tool

Tool 1 – Quantitative Survey (Self-Administrated Questionnaire)

Research Title: IMPLEMENTATION OF AN INNOVATIVE DYNAMIC AND MULTIDIMENSIONAL LEADERSHIP MODEL IN PROJECT MANAGEMENT: A CASE STUDY OF THE ENGINEERING AND CONSTRUCTION INDUSTRY

You are hereby invited to complete the forty (40) questions given in this self-administrated questionnaire (SAQ) to assist the researcher in exploring and investigating leadership behaviour and styles exhibited by project managers (leaders) in engineering and construction industry. This SAQ should not take more than 20 minutes to complete, and all questions shall be answered.

By responding to this SAQ, you confirm the understanding that your identity shall remain anonymous; and that your responses shall be kept anonymous as well; and will not be correlated with you in any way. You have the right to withdraw from this survey at any stage (prior or post the completion) of the research without any consequences and without providing any explanations. In this case, any data collected will be deleted.

Please check the box to give consent for participation in this survey ☐

Part I: Introductory Questions

Please complete the introductory questions I to V.

I. What is your gender?
   A. Male
   B. Female
   C. Other
   D. Prefer not to answer

II. In which geography your office is based?
   A. North America and/or Canada
   B. Europe
   C. Australia
   D. Middle East
   E. Asia
   F. Prefer not to answer

III. What is your country of citizenship?
   A. …………………………….
   B. Prefer not to answer

IV. What is the number of your years of experience as a project manager?
   A. …………………………….
   B. Prefer not to answer

V. What is the number of your direct reports/team members/subordinates?
   A. Less than 5
   B. 5 to 10
   C. More than 10
   D. Prefer not to answer

Part II: Survey Questions

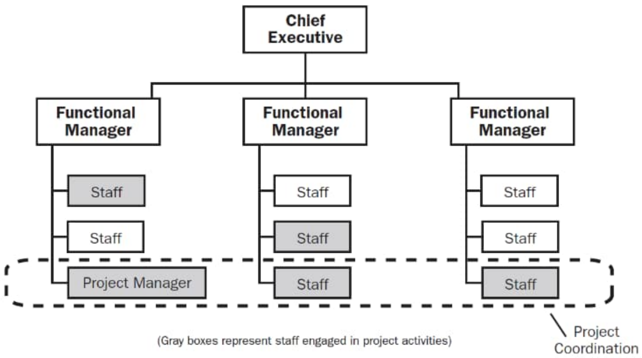
Please attempt all 40 questions, on pages 2 and 3, to the best of your knowledge by inserting the relevant number (1 to 5) in accordance with the scale below.

1: Totally Disagree 2: Somehow Disagree 3: Neutral 4: Somehow Agree 5: Totally Agree

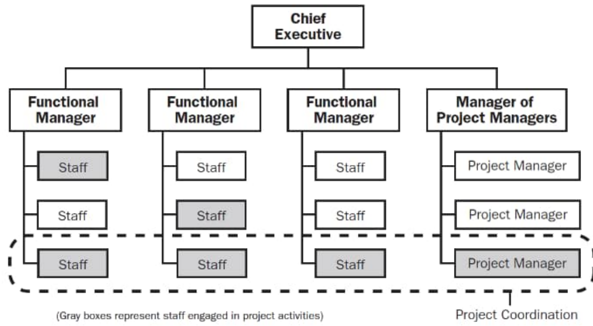
Ref.	Question	Response 1 to 5
01	Besides management and administrative competency and skills, the leadership behaviour of a project manager directly contributes to project success in large and complex engineering projects	
02	A project manager should exhibit a consistent leadership style throughout the entire life cycle of the project regardless of team size and diversity, team professional maturity, and project complexity	
03	A project manager who changes his/her leadership styles according to the situation in hand might be perceived by his/her team members as unconfident or lacking direction	
04	Complex engineering projects that involve many stakeholders require authoritative leadership styles to ensure that team members comply with requirements and deadlines	
05	Empowering team members in large complex projects always has a positive impact on project delivery	
06	Empowering team members in large complex projects, for carefully selected aspects of the project only, always has a positive impact on project delivery	
07	Delegation to leadership to some and/or all team members has a positive impact on project delivery	
08	Switching between leadership styles is justifiable based on situations and characteristics of team members	
09	Leadership behaviour among project team members has significant impact on project performance	
10	A *projectized* organizational structure is more effective than a *balanced* organizational structure for the delivery of engineering projects (refer below to illustration of projectized and balanced structures)	
11	A *projectized* organizational structure is more effective than a *Strong* organizational structure for the delivery of engineering projects (refer below to illustration of projectized and strong structures)	
12	Setting a rewarding system upfront will further motivate the project team members to meet project objectives and targets	
13	Project leaders commonly assess project complexity at the initiation stage in order to determine the most effective project governance, team setup, and leadership styles.	
14	The internal organizational structure of an engineering firm might sometimes be debilitating and make project performance less efficient especially for the case large complex projects. Example, unclear governance and communication channels.	
15	Leadership styles should be suited to the national culture of team members. For example, leadership styles that tend to be directive have a more effective influence on performance in eastern cultures.	
16	As a project leader, would you promote leadership among team members instead of be exclusive to task-based approaches?	
17	In crisis situations (e.g. project considerably behind schedule), a project leader should still empower employees and promote shared leadership instead of being directive.	
18	A project leader should be conscious to individuals' traits and needs in addition to being attentive to the collective characteristics of the project team members as a whole.	
19	Among the numerous factors contributing to engineering project complexity, technical aspects are deemed as the most governing factors in defining project complexity.	
20	Among the numerous factors contributing to engineering project complexity, stakeholders' environment is deemed as the most governing factor in defining project complexity.	
21	Among the numerous factors contributing to engineering project complexity, external business environment is deemed as the most governing factor in defining project complexity.	
22	Project leaders normally think about projects as systems of interconnected elements rather than as discrete processes undertaken sequentially in time in a prescribed methodology.	
23	Modern engineering design and construction projects are dynamic and leadership behavior exhibited by project leaders should accordingly be tailored to account for this hypothesis.	

24	In international projects, leadership styles that are preferred in certain situations when leading team members in-person also apply to virtual teams	
25	An authoritarian leadership style is more effective for leading large virtual teams with multi-national cultures	
26	In Eastern cultures, complex task environments make subordinates and team members more precautious and oriented to be led rather than empowered.	
27	In Western cultures, complex task environments make subordinates and team members more precautious and oriented to be led rather than empowered.	
28	In complex problem-solving situations, a project leader should independently decide on whom to engage from team members.	
29	Organizational project management maturity plays an important role in the successful delivery of engineering projects. For example, a strong project leader and skillful team members would still struggle if the organization itself has unsatisfactory maturity level in terms of governance, policy, procedures, standards, guides, among others.	
30	Globalization has changed the way project leaders behave. For example, building a bridge two decades ago is different than building the exact same bridge in the 21st Century.	
31	Increasing project complexity warrants more authoritative leadership style to ensure alignment of the team	
32	Creating sub-groups (sub-teams) with delegated leaders is preferable when a project manager is leading a project team that has more than 10 members.	
33	If a project team has a few disciplines such as structures, roads, and waterworks, then as a project manager you normally do not experience a conflict in leadership with the functional managers of these disciplines.	
34	When leading global projects, a project leader can simultaneously adapt to more than one leadership style based on team members characteristics (values, backgrounds, national culture, etc).	
35	Leading a virtual team requires leadership style(s) different than those exhibited when leading the same team in-person.	
36	When leading virtual teams, it is normally easy to divide the team into sub-groups in order to exhibit a different leadership style with each sub-group.	
37	A project leader can be authoritative and supportive at the same time.	
38	A project leader should always coach his team members regardless of their experience and backgrounds to ensure alignment and effective performance.	
39	A project leader should always lead by example during complicated situations to set the path for the team members notwithstanding their backgrounds and level of experience.	
40	When running complex and risky projects, a project leader can adapt to different leadership styles when trust is built with a project team during the life cycle of the project. For example, a leader can become less authoritative and empower team members by delegating more important tasks.	

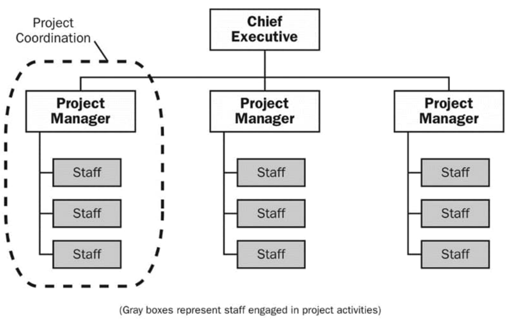
Types of project management organizational structures (Guidance on questions 10 and 11).



Balanced Project Management Structure



Strong Project Management Structure



Projectized Project Management Structure

Source: adapted from PMI (2013) "A Guide to the Project Management Body of Knowledge"

Appendix G

Qualitative Data Collection Tool

Tool 2 – Qualitative Survey (Semi-structured and Unstructured Interview Questions)

Research Title: IMPLEMENTATION OF AN INNOVATIVE DYNAMIC AND MULTIDIMENSIONAL LEADERSHIP MODEL IN PROJECT MANAGEMENT: A CASE STUDY OF THE ENGINEERING AND CONSTRUCTION INDUSTRY

Preamble

The interview will be conducted online via Microsoft Teams and consists of two parts, namely: Part I which includes five introductory questions, and Part II which has thirteen semi-structured and unstructured questions. The interview will be video, or audio, recorded using the meeting recording feature in Microsoft Teams. This feature also generates a reasonably accurate transcript for the conversation. The transcript will be reviewed in conjunction with the recording to correct any erroneous syntax and wording. The interviews recordings and transcripts will be saved in a prescribed designation to ensure anonymity and ease of reference. The designation includes sub-fields (pointers) for geographic location, market sector, gender, and years of experience as a project leader.

Interview Protocol

- Interview invitations will be sent via Microsoft Outlook to all participants (30 nos. project leaders). The invitation message will succinctly outline the purpose of the interview. Worth noting, the selected participants will already have a background about the research subject and the researcher.

- Upon joining the online call, the researcher will begin by introducing himself, welcoming the participant, and thanking him/her for participation in the research. The researcher will then inform the participant that the video call will be recorded and proceed with the recording after obtaining verbal consent (note: the Informed Consent Form mentions that the interviews will be recorded).

- Subsequently, the researcher will briefly describe the research subject, purpose of the interview, types of questions, and the expected interview duration. Further, the researcher will address and reassure confidentiality and anonymity as already signed off in the Informed Consent.

- At completion, the researcher will inform the participant that the recording has stopped, and will also reassure that the interview's video, or audio, recording and transcript will be archived using a document management application that has a military-grade security and protection capability.

Further details about the interview facilitation, setup, tools, and procedures will be provided in Chapter 3 write up.

Part I: Introductory Questions (5 minutes)

(1) What is current your job title, and how long have you been leading projects?
(2) Do you or did you work in different geographies? How many global projects did you lead?
(3) What is your market sector (business line) of focus? (e.g. buildings, infrastructure, energy, etc)
(4) How many people currently report to you? What is the largest team size you had in the past?
(5) Have you been working on public and/or private projects?

Part II: Semi-structured and Unstructured Interview Questions (45 – 60 minutes)

Part II comprises thirteen questions, including sub-questions (Edmonds & Kennedy, 2017). The average time allocated to each question is approximately five minutes. The interview duration, in the range of 45 to 60 minutes, could be extended based on the availability of the participant. Ideally, an interview duration of 75 minutes would adequately cover the thirteen questions based on an informal pilot test carried out by the researcher during the research proposal stage.

Most importantly, the semi-structured and unstructured questions articulated in Part II hereafter are used as guidelines. The researcher will use probes during the interview, rephrase, ask further open-ended questions, and carefully steer the dialogue based on the interviewee's response and the emergence of the discussion in order to focus on the specific areas, relevant to the research subject and the theoretical framework, and to solicit further clarifications as necessary.

Ref.	Question
01	In your opinion, to what extent leadership behaviour of a project manager directly contributes to project success in large and complex engineering projects?
02	Based on your past project management experience, do you agree that a project manager should exhibit a consistent leadership style throughout the entire project's life cycle? If not, can you give examples from your past experience on when it is advisable to change leadership styles?
03	Can you describe an event when you had to change your leadership style? What were the reasons behind that? Was project complexity one of the drivers for such change? Do you think team members characteristics played a role in this respect? (*Researcher will probe to solicit further answers*)
04	Some professionals argue that an authoritative leadership style is more suited for complex engineering projects that involve many stakeholders. What is your opinion on this?
05	Do you agree that empowering team members in large complex projects always has a positive impact on project delivery? Can you briefly describe a situation from your past projects where empowerment did not yield the desired outcome?
06	When managing and leading project team(s), do you usually encounter difficulties in running projects where functional managers have control of their resources (i.e. team members)? What did you do to overcome such a challenge? Relatedly, do you believe a *projectized* organizational structure is more effective than a *balanced* organizational structure for the delivery of engineering projects. (*Researcher will briefly describe the difference between projectized and balanced structures to ensure clarity. In practice, keen and certified project managers know the difference; however, the researcher will explain the difference to avoid any ambiguity*).
07	Can you briefly describe instances where the internal organizational structure of the firm worked against project performance? In what ways such structure was impeding? What did you do as a project manager to overcome the relevant challenges?
08	Based on your experience in global projects, how can you correlate leadership styles with local national culture of team members. Can you give specific examples?
09	Have you ever been appointed to a distressed (problematic) project? Or to a project in a crisis situation that was behind schedule and/or budget? As far as project leadership is concerned, would you please elaborate on the remedial measure which you had undertaken to recover the project? Was the project fully recovered? If not, what were the reasons, and what was the ultimate outcome? (*In this specific context, the researcher acknowledges that not all projects are normally rectified, and sometimes there is either partial success or total failure with lessons learned. The researcher will probe to solicit the lessons learned in a transparently open fashion*).
10	In leading teams, are you normally conscious to individuals' traits and needs? Due to the nature of engineering projects in the 21st Century, some might argue that it is often difficult to be attentive to everyone's personal needs, so how much effort do think a leader should be empathetic thereby giving towards the human side of leading people?

11	Regarding project complexity, what are the primary factors that, in your opinion, contribute to complexity? Is there any proprietary or international framework that you think is useful to identify complexity? Have you used such complexity rating systems during early project appraisal (i.e. during pursuits and preparation of proposals for submission to the client).
12	Following on the previous question, stakeholders' environment and external business environment are deemed as the most governing factors in defining project complexity. How much do you agree with this statement? What in your opinion are the governing factors that define project complexity in the engineering industry? (*Researcher will probe to solicit answers and filter out and categorize the contributing factors*)
13	*Systems Thinking*. Have you adopted a Systems Thinking approach when leading projects? Can you tell me more about this? (*Researcher will briefly describe Systems Thinking to ensure that a relevant answer is obtained from the participant*).